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## Journal of the Society of Arts.

FRIDAY, APRIL 23, 1858.

### THE LATE MR. R. HORSMAN SOLLY.

The Secretary has received a communication from the Executors of the late Mr. Solly, to the effect that he has bequeathed to the Society the sum of One Hundred Pounds.

### CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday next, the 24th April, at the Society's House, the card for which will admit the member only; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit the member and two friends, ladies or gentlemen. The cards for each of these evenings have been issued.

Members of Institutions in Union who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

### TENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 5th inst.

The Exhibition will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members, by ticket, or written order bearing their signature, may admit any number of persons. The number of visitors up to yesterday, the 22nd inst., was 2,702.

### LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty Local Boards have been formed. Returns of the Candidates who have passed the Previous Examination have been received up to the 22nd inst., as follows:—

Louth .....	4
Wigan .....	6
West Hartlepool.....	3
Leeds (Christian Institute), No. 1. ....	14
Northowram .....	1
Portsmouth.....	2
Warminster.....	1
Banbury .....	2
Macclesfield.....	83
Newcastle-on-Tyne .....	3
Lynington .....	1
West Brompton .....	4
Leeds, No. 2. ....	10
Wakefield .....	4
Pembroke Dock .....	4

Ipswich .....	6
London Mechanics' Institution.....	8
Manchester Mechanics' Institution .....	32
Selby .....	9
Bradford .....	18
Halifax, No. 1. ....	15
Salisbury .....	1
Sheffield .....	18
Liverpool .....	35
Lockwood .....	1
Halifax (Working Men's College), No. 2. ....	21
York .....	7
Berkhamstead .....	19
Bristol .....	11
London Domestic Mission .....	1
Royal Polytechnic Institution .....	28
Birmingham, No. 1, Messrs. Chance's .....	
Reading Room .....	2
Sheerness .....	1

### EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date:—

T. D. Acland, Member of Council.....	£ 5 5
The Rt. Hon. C. B. Adderley, M.P. ....	5 0
John Ames.....	5 5
J. G. Appold, F.R.S., Auditor .....	10 10
T. H. Bastard .....	5 0
Messrs. Chance, Brothers .....	10 10
R. L. Chance .....	5 5
Harry Chester, Vice-Pres. ....	10 10
J. P. Clarke .....	1 1
G. Clowes .....	10 10
Henry Cole, C.B., Vice-Pres. ....	1 0
H. D. Cunningham, R.N. ....	1 1
C. Wentworth Dilke, Vice-Pres. Chairman } of Council (third donation) .....	10 10
Thomas Dixon .....	1 1
Lieut.-Col. F. Eardley Wilmot, R.A. ....	5 0
Lord Ebury .....	5 0
J. Griffith Frith, Member of Council .....	5 5
J. W. Gilbert, F.R.S., Treasurer (second } donation).....	10 10
F. Seymour Haden (annual) .....	2 2
William Hawksworth .....	1 1
Edward Highton (annual) .....	£ 2 2
James Holmes (annual) .....	1 1
The Marquis of Lansdowne, Vice-Pres.....	20 0
George Lowe, F.R.S. ....	1 1
The Master of the Mint, Member of Coun- } cil (second donation).....	10 10
George Moffatt, M.P. ....	10 10
Sir Thomas Phillips, Member of Council ...	5 5
William T. Radford.....	1 1
Charles Ratcliff, Hon. Local Sec. (annual)...	10 10
Joseph Skey, M.D. ....	1 0
William Tooke, F.R.S., Vice-Pres.....	10 10
Arthur Trevelyan .....	1 0
T. Twining, jun., Vice-Pres. ....	10 10
Dr. J. Forbes Watson .....	1 1
G. F. Wilson, F.R.S., Member of Council } (third donation).....	10 10

### NINETEENTH ORDINARY MEETING.

WEDNESDAY, APRIL 21, 1858.

The Nineteenth Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 21st inst., W. R. Grove, Esq., Q.C., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Beale, Lionel S., M.D.	Salisbury, the Marquis of,
Davies, George	K.G.
Gifford, William J.	Todé, Edward Henri
Loxley, John	Webster, James Porter
Maguire, John Fras., M.P.	Winder, Thos. Robt., C.E.

The following Institution has been taken into Union since the last announcement :—

St. Bartholomew's Working Men's Literary Institute.

The Paper read was—

#### ON THE PROGRESS OF THE ELECTRIC TELEGRAPH.

By C. W. SIEMENS, C.E.

The growing importance of the electric telegraph, both in a scientific and social point of view, and the circumstance of my connection for a good many years with its practical development, are the apologies I have to make for venturing to occupy the attention of the Society this evening.

The object which I have more particularly in view is to trace the gradual course of progress of this invention since the time of its first appearance upon the stage, without pretending indeed to establish any new historical facts or to decide upon the relative merits of contending claimants to invention or discovery, (although I shall not willingly offend against the right of anyone), but with a view to establish more clearly our present position in the scale of progression, and to point out with some degree of certainty the direction in which we should travel in order to realise still greater results, particularly the accomplishment of transoceanic communication.

When, little more than a century ago, Franklin, the father of electrical science, ascertained that atmospheric electricity, which manifested itself in the imposing form of thunder and lightning, was identical with frictional electricity, he employed an apparatus comprising an insulated metallic conductor, the electric machine, the earth return circuit, and a receiving instrument, consisting of a pair of cork balls, suspended by silk threads, which, upon being electrified, struck against a pair of signal bells. This apparatus comprised, indeed, all the elements required for the construction of a modern electric telegraph. Nor was the idea of an electric telegraph new, even in the days of Franklin, for we are informed that as early as the year 1728, a pensioner of the Charter House, named Stephen Grey, made electrical signals through a suspended wire, 765 feet long. Yet a century of unceasing efforts, by men of all civilised nations, including some of the greatest natural philosophers the world ever produced, was still required to reduce those elements into available forms for practical purposes.

If we pass over the experiments by Winkler, of Leipzig, in 1746, Watson, of London, and Le Monier, of Paris, in the year following, as preliminary inquiries into the velocity of the electric current in metallic conductors, we find that the honour of having produced the first electric telegraph is due to Lesage, of Geneva, who actually constructed, in 1774, an experimental line of communication, consisting of 24 suspended line wires, representing the 24 letters of the alphabet respectively. Each wire terminated in a pith ball electrometer, the balls of which separated, upon the wire in question being charged at the other extremity by means of a Leyden jar, denoting the letter intended to be communicated. Lomond, of France, perceiving the difficulty and expense attending so many line wires, contrived, in 1787 (see "Young's Travels in France," 1787), an experimental line of telegraph in his house, consisting of only one line wire connected with a pith ball electrometer

at both ends, and he proposed a telegraphic code by repetitions of his only primitive signals. Reissner, Dr. Salvo, of Madrid, and many others proposed various modifications of the same apparatus, but it is hardly necessary to add that all of them remained unrewarded by success.

In consequence of so many fruitless attempts, electric telegraphs were already being classed among the chimerical projects of the time when at the dawn of the present century a new field for invention was opened by the important discoveries of the Italian philosophers, Galvani and Volta.

The voltaic current, unlike the spontaneous discharge of static electricity, could be conducted with comparative facility through long metallic conductors, and was capable of very powerful effects in decomposing water or other substances, which qualities rendered it clearly preferable for telegraphic purposes.

Struck by these views, Soemmering, of Munich, constructed, in 1808, the first voltaic telegraph, consisting of 35 line wires, any two of which could be combined to form the electric circuit and produce a signal at the other extremity by decomposition of water under any two of 35 inverted glass cups, arranged side by side in an oblong bath of acidulated water. The 35 wires terminated in gold points, under the inverted glass cups (or voltameters), and the rising of the gases of decomposition betrayed to the attentive observer the passage of the current.

The difficulty of dealing with so many wires suggested to the mind of Schweigger the same expedient which Lomond had recourse to with regard to static electricity, that of reducing the number of line wires to a single metallic circuit, and the receiving instrument to a single decomposing cell, having recourse to repetition, and to differences in the duration of succeeding currents, in arranging his telegraphic code.

It seems not improbable that if electrical science had made no further advances, the projects of Soemmering and Schweigger would have gradually expanded into practically working chemical electric telegraphs, such as have been proposed at a much later period by E. Davy, 1838, Morse, 1838, Bain, 1843, and Bakewell in 1848, which latter is particularly interesting inasmuch as not mere signals or conventional marks are received by it, but a fac-simile of the message, previously written with a solution of shellac upon a metallic surface.

The discovery of Oersted, in 1821, which, under the hands of Schweigger, Ampère, Arago, and Sturgeon, soon expanded into electro-magnetism, turned the tide of invention into quite another direction. Ampère was the first to propose an electro-magnetic needle telegraph, consisting of 24 needles, representing each a letter of the alphabet, and 25 line wires, the extra wire being intended for the metallic return circuit common to all. Ritchie executed, in 1832, a model of Ampère's telegraph, with an essential improvement, to the effect that each needle, by its motion, moved a screen disclosing a letter of the alphabet.

Another version of the same general arrangement was patented by Alexander, of Edinburgh, as late as 1837. Fechner, of Leipsig, and Schilling von Canstadt, of Russia, proposed, in 1832, apparently independently of each other, a single-needle telegraph, with deflection of the needle to the right and left; and Fechner was the first to prove, by calculation, the power of the galvanic current to traverse a great length of line wire.

Gauss and Weber, of Goettingen, took up the subject of electric telegraphs at about the same time, but had not proceeded far when their attention was diverted by the great crowning discovery in electrical science, I mean the discovery of induction and of magneto-electric currents by Faraday, in 1831.

Gauss and Weber rightly judged the superiority of magneto-electric over voltaic currents for telegraphic purposes, and in applying them they effectually established the first working electric telegraph in 1833, with the ar-

rangements of which I became practically acquainted some years later, when a student at Goettingen.

It consisted of a line wire and return current wire, the former of which was carried upon high posts over the town of Goettingen, extending from the observatory to the tower of the public library, and thence to the new magnetic observatory of Weber, a distance of little more than an English mile. The magneto-electric current was produced by means of a coil containing 3,500 turns, which was situated upon a compound bar magnet, weighing 75 lbs., the coil being at liberty to slide freely to and fro upon the bar. In sliding the coil rapidly from the centre toward the south pole of the magnet and back again, a succession of two opposite currents was produced, which, traversing the line-wire circuit, including coils of the receiving instrument, caused a short jerk of the needle, say to the right and back again, whereas the deflection of the needle would be to the left when the exciting coil was moved towards the north pole and back. The amount of motion imparted to the coil determined also the amount of deflection of the needle, and could, by means of a telescope and a scale, be read off in degrees on a reflector attached to the end of the needle. The needle itself weighed 100 lbs., and was suspended from the ceiling of the room by untwisted silk. Notwithstanding the extraordinary weight of the needle, (which was the same as that used by Gauss to determine the laws of terrestrial magnetism) its motions were beautifully energetic and distinct when viewed through the telescope. Gauss and Weber did not pretend, however, to the construction of a commercially useful electric telegraph, but delegated that task to Steinheil, of Munich, who enjoyed already at that time a reputation as a skilful mechanic. Steinheil applied himself vigorously to the task, and produced, in 1837, his needle printing and acoustic instruments, which he first tried at Munich through about 5 miles of suspended line wire and shortly afterwards upon the Taunus Railway, near Frankfurt. In trying whether the rails might not be used for metallic conductors, he re-discovered the conducting power of the earth itself, which, it appears, had been lost sight of since it had first been discovered by Franklin with regard to static electricity, and proved also with regard to Voltaic electricity, in 1803, by Erman, Basse, and Aldini.

The first recording instrument, and the telegraphic earth circuit, are discoveries which entitle Steinheil to a high position among the originators of the electric telegraph, although the means he proposed for its execution were too refined for the time, and did not lead on that account to immediate practical results.

At the time when Steinheil was absorbed in his labour, Professor Wheatstone was also engaged upon a series of experiments on the velocity of electricity, with a view to the construction of electric telegraphs, and in June, 1837, he joined Mr. Cooke in a patent for a needle telegraph of five line wires (besides one wire for the return current), and as many needles, which, by an ingenious system of permutations, could be so deflected that any letter of the alphabet was pointed out upon a diamond-shaped board by the convergence of two needles towards it. The line wires were proposed to be coated with insulating material, such as fibrous substances saturated with pitch, and to be drawn into leaden pipes, in order to exclude the moisture of the ground into which they were intended to be laid. An experimental line of telegraph on this principle was established in the same year, at the Euston Railway Station, and the results obtained left, it appears from documentary evidence, no doubt upon the mind of the then resident engineer of the London and Birmingham Company, the present Sir Charles Fox, of its ultimate success. That success, however was not obtained without a struggle against practical difficulties, in the course of which the system underwent important modifications, of which the double needle instrument, such as is still used extensively in this country, and (in 1843) a return to overground line wires, were the results.

To Cooke and Wheatstone is due the credit of having established the first commercially useful lines of electric telegraph, namely, the lines between Paddington and Drayton, commenced in 1838, and between London and Blackwall, commenced in December 1839, which were soon followed by others.

If viewed from our present position, the needle telegraph cannot be considered an advance, in point of principle, on Gauss and Weber, or Steinheil: it involved, in fact, a return from magneto-electric to Voltaic currents—from a single-line wire to several—and from recording of messages, to their mere indication; yet, for the time being, when insulation was imperfect, and the important law of Ohm was hardly understood, except by a few natural philosophers, it had the probability of success in its favour, because the duty required from the electric current consisted in deflecting a magnetic needle to a merely appreciable extent, and it was of no great importance to the result whether a more or less considerable proportion of the current was lost through imperfect insulation. The upright weighted needle—the key with dry metallic contacts—and other details, were also of a novel and meritorious character. Why the same system should however be still persisted in at the present day, in this country, when improved systems have been adopted in nearly all other countries, including the British possessions, is a question which, I hope, will receive an answer from those who practically uphold it. It is evident, however, that Wheatstone did not intend to stop there, from his numerous other inventions, which followed each other in rapid succession, and amongst which his dial and printing instruments—his early applications of magneto-electric currents—the relay—and the first judicious application of electro-magnets, so as to obtain more powerful effects at distant stations, are the most remarkable.

The country of Franklin has not been behindhand in gathering the first fruits of electrical science. It is said that Morse contemplated the construction of an electric telegraph since the year 1832, although he did not take any overt step till the year 1837, when he lodged a caveat in the American Patent Office, which patent was not enrolled till the year 1840. There is no evidence to show that Morse's early ideas had assumed any definite shape until the year 1838, when he deposited an instrument of his construction at the Paris Academy of Sciences. Morse's invention consists chiefly in the substitution of electro magnets for needles in the construction of a recording instrument, which, in other respects, is similar to Steinheil's. The step was, however, an important one to render the instrument powerful and certain in its action, and, combined with Wheatstone's relay, Morse's recording instrument will, it may be safely affirmed, be used universally for all except local telegraphic communication.

In the year 1845, when the practical utility of electric telegraphs had been demonstrated in England, several continental governments determined upon their establishment. The Belgian, Austrian, and, a few years later, the Sardinian government, simply adopted the double needle telegraph. In France, Messrs. De Foy and Breguet, fils, contrived a double step by step or dial telegraph on Wheatstone's principle, which enabled them to imitate the same code of signals which had been used for the Semaphore telegraph.

In Prussia a royal commission was appointed to consider and advise upon the system to be adopted, of which commission my brother, Werner Siemens, who had been engaged before with kindred subjects, became the most active member. The commission was in favour of an underground system, and charged Werner Siemens to institute experiments. About this time gutta percha had become known in this country, and having been struck with its peculiar plasticity, I forwarded my brother a sample, to see whether he could use it for the purposes he had in view. He soon discovered its remarkable insulating properties, and recommended an experi-

ment on a large scale, which having been sanctioned, he completed a line of from four to five English miles (between Berlin and Gross-Beeren) successfully in the summer of 1847. The machine he designed for covering the copper wire with gutta percha is nearly identical with the cylinder machine still used for the same purpose. In the spring of 1848, a considerable length of gutta percha coated copper wire was submerged in the harbour of Kiel for military purposes, but it was found that, owing probably to the impurity of the material, the gutta percha underwent a gradual change, as though it was penetrated by the sea-water, to counteract which Werner Siemens proposed, with apparent effect, to mix a small proportion of sulphur with that substance. In the same and following year more than a thousand miles of gutta percha coated line wire was laid down underground, and proved successful for several years, when it began to fail, for the most part, in consequence of the impure and adulterated condition of the material then supplied. Although the underground line wire has, for the most part, been superseded again by the suspended wire, I venture to assert that we shall eventually return to it for all principal lines, for reasons which I shall enumerate hereafter. The experience gained in this great experiment has been most valuable in paving the way to submarine cables, which, at the present time, occupy so large a share of public attention.

The instruments which Werner Siemens at first proposed, and which are still used extensively on the continent for railway purposes and town service were dial instruments, involving a peculiar principle, inasmuch as no communicating instrument or any clockwork is employed, but the two or more instruments, connected by the single line wire, break and restore the electric circuit by the action of their own armatures, in a similar way to a steam engine, which alternately intercepts and restores the communication with the boiler. In arresting the ratchet wheel of any one of the instruments within the circuit, by depression of a key, bearing a certain letter of the alphabet, the armature of the instrument in question is prevented from restoring the electric circuit, and the hands upon the dials of all the instruments in circuit must stop, pointing all of them to the same letter, until the depressed key is again released. The advantages of this arrangement over previous dial instruments are that the communicating instruments are less liable to fall out of step, and that considerable power of action is obtained, because the batteries of all the intermediate and end stations act in concert, being all included in the general circuit. The dial instrument is in some instances accompanied by a type printing instrument, differing from Wheatstone's and House's arrangements, inasmuch as it is entirely self-acting, the motion of the type wheel, of the paper, and even of the hammer striking the blow upon the type, being effected by electro magnets instead of clockwork, or of an air cylinder, as is the case in House and Brett's arrangement.

Since the time of the first successful introduction of the electric telegraph, a great variety of instruments, insulators, and other appliances, have been proposed, amongst which the chemical recording instruments of Bain and Bakewell, the modifications of Wheatstone's magneto-electric needle, and dial instruments by Henley and Stoehr, the various combinations by Messrs. Highton, Clark, and Bright, and the more recent productions of Mr. Varley and Mr. Whitehouse, are of undoubted merit in having contributed to the general progress of electric telegraph engineering. To describe them here would be a task far exceeding the limits of this paper, and I shall therefore proceed at once to point out what, in my opinion at least, supported by actual experience, are the best means to be adopted, at the present time, for extending the electric telegraph, both on land and across the seas.

The foregoing sketch of the gradual development of the electric telegraph, may serve to show that the par-

ticular arrangements adopted to indicate or register the message, or the particular combination of elementary signs, is of secondary importance, but that every essential progress is marked by the discovery of some new means of generating currents of greater dynamic power, or of producing by their means more decided effects at the further extremity of the conductor.

Let us inquire, then, what are the conditions of current generator, current conductor and receiver, best calculated to realise a maximum of palpable effect at great distances.

Inquiry into these questions is of particular interest at the present time, when great efforts are being made to extend telegraphic communication across the Atlantic and Indian oceans, distances far exceeding the length of any land lines yet constructed.

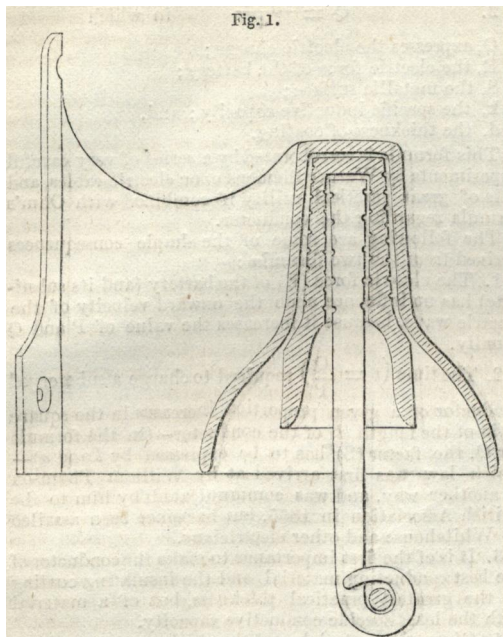
Among the different varieties of electricity hitherto applied to telegraphic purposes, that produced by friction possesses the greatest tension or power to overcome resistance in the conductor. But its discharge is instantaneous, and it is, therefore, ill-suited to produce dynamic effects with time or duration for a factor.

The Voltaic current, on the contrary, may be considered as absolutely continuous, and, therefore, as best suited to produce powerful effects, but it is deficient in tension, unless a great number of elements are employed, in which case it becomes expensive and troublesome. A battery of sufficient intensity to convey an effect through the Atlantic cable, would have to be composed of at least 500 Daniell's cells, according to ordinary practice, but I apprehend that the internal resistance of such a battery would of itself annihilate its presumed power, and that practically no battery of sufficient power could be thus constructed.

The magneto-electric currents hold an intermediate position between the two just referred to. Their intensity can be increased almost indefinitely, and they are of a perceptible duration (the time required to charge an electro magnet). They may be produced by mechanical agency, on separating a permanent magnet from its armature or surrounding coils, or by means of a voltaic quantity battery and primary coils; and are, in both instances, by far the cheapest and least variable description of electric currents. The reason why, since the discovery of magneto-electricity in 1831, it has again and again been abandoned in favour of battery currents, may be traced to the imperfect means hitherto known or adopted for its generation or suitable application; but I hope to prove hereafter that it can be employed at present with perfect success.

Regarding the electric conductor or line-wire, this is either suspended upon poles in the open air, or it is imbedded in gutta percha, and interred or submerged. Suspended line-wire generally consists of galvanised or painted iron, of from one-eighth to one-fifth of an inch in diameter, and supported, at intervals of from 50 to 60 yards, from posts by means of insulators. The construction of a really efficient insulator has for many years occupied the serious attention of electrical engineers, for upon it chiefly depends the permanent efficiency of the line. A great variety of insulators have been tried, some of which I am enabled, by the kindness of the Electric Telegraph Company, to present to the meeting. According to continental experience, the insulator of Siemens and Halske (Fig. 1), has been found to combine the desiderata of strength and insulating property in the highest degree. It consists of a cast-iron bracket, assuming the form of an inverted bell, with a cylindrical recess at the bottom. A capsule of porcelain is firmly cemented, by means of sulphur mixed with caput mortuum, into the recess, and into this again a stalk of iron is cemented, which, forming a peculiarly twisted loop at the end, supports and secures the line-wire. The insulating property depends upon the dryness of an apron-like extension of the porcelain capsule, which, under the protection of the cast-

iron ball, is not affected by either rain or dew. Every tenth support is a stretching-post insulator, at which the



INSULATOR.

line-wire is not only supported but held firmly by means of claws, an arrangement which has been found very convenient during the erection of the line-wire, and in case of repairs. An idea of the importance of a good insulator may be formed from the fact, that the cost of finding and repairing a single defect of the line-wire, in a country like Russia, amounts on the average to £30.

We now approach the subject of submerged conductors, which, at the present time, engrosses the attention of electrical engineers, and also commands a large share of public interest, owing both to the difficulties with which it is surrounded, and the vast importance of the object in view.

Regarding the history of submarine cables, it appears that the first experiments, on a small scale, to submerge an insulated conductor (copper wire coated with cotton thread saturated with pitch and tar) were made at Calcutta, in 1839, by Dr. (now Sir) William O'Shaughnessy.

Professor Wheatstone proposed, in the following year, to establish a telegraph cable between England and France, and prepared very elaborate and well-considered plans, which, by his kindness, I am enabled to place before the meeting. The cable Wheatstone proposed contained 6 separately insulated copper wires which were protected by a strong sheathing of iron, differing, however, from the sheathing now generally adopted, in being devoid of strength in a longitudinal direction.

Submarine telegraphs must, however, have proved impracticable but for the timely discovery of gutta percha, and of its remarkable insulating properties. It is, therefore, not surprising that the first successful attempts to establish sub-aqueous conductors were made by Werner Siemens, in 1848, in the bay of Kiel, and in crossing the Rhine at Cologne, and other rivers.

The gutta percha coated copper wire was at first submerged without outer protection, but it was laid by the side of a strong chain to protect it from anchors. In the following year, however, a lead coating was introduced.

The first attempt to establish a sub-aqueous conductor across the open sea (from Dover to Calais) was made by Wollstone, in 1850. It consisted of a gutta

percha coated copper wire, without external protection; and failed immediately after it had been laid. In the following year, Crampton laid a cable between the same places successfully. This cable was sheathed with iron wire, according to Messrs. Newall and Co's. patent process, which gives great longitudinal strength, and has been generally adopted ever since, except in the instance of the Varna-Balaclava cable (laid by Messrs. Newall and Co. in 1854), which had no sheathing, excepting at the shore ends, and which worked successfully till just before the evacuation of the Crimea by the allies.

It would be tedious to notice the numerous successful and unsuccessful attempts which have been made since the year 1837, to establish submarine cables, suffice it to state the general results of the experience obtained, which goes to prove that the difficulty of submerging and working submarine cables is small in shallow and narrow waters, but increases in a very rapid ratio with the depth and breadth of the ocean to be traversed.

An inquiry into this most interesting subject may be divided into three sufficiently distinct heads, namely, the mechanical problem of constructing and submerging the cable; the electric condition of the submerged cable; and, lastly, the question of suitable instruments.

The mechanical problem has been discussed lately at great length at the Institution of Civil Engineers, I therefore propose to limit myself to a recital of the principal points of interest which may be considered as established both by theory and in practice.

The cable should be of small specific weight and of great tensile strength, in order that its descent through the water may be retarded by the resisting medium to such a degree that the velocity of maximum acceleration may not exceed one-fourth, or at most one-third, of the velocity of the vessel. This condition of a "balanced cable" being fulfilled, there remains the tendency of the cable to slide down the inclined trough of the water, and it has been proved that this force equals, under all circumstances, the weight of a length of cable (less the weight of water it displaces) reaching from the vessel perpendicularly to the bottom of the sea. The same amount of retarding force must at least be applied to the paying-out brake, to prevent great waste of cable, and the cable itself must of course be sufficiently strong to bear this strain without injury to the insulated wire or wires.

Messrs. Longridge and Brooks have been the first to prove, I believe, that currents in the ocean cannot sensibly augment the strain upon a descending cable, nor are they likely to occasion considerable loss.

It has been proposed to increase the floating power of deep-sea cables, by attaching floats at intervals; but it appears to me that such appliances, which depend upon the unerring dexterity of workmen at the moment of danger, and which moreover do not relieve the cable from retarding strain at the brake, should be discarded, and the cable be made to possess in itself all the requisite degree of buoyancy and strength. For this purpose, the conducting wire or wires should be as light as possible consistent with good conducting power, a combination of properties which seems to point to the newly discovered metal, aluminium, as likely ultimately to supersede copper. The insulated covering of gutta percha increases the bulk without adding to the weight of the cable, being nearly of the same specific gravity as sea water, it improves both the mechanical and electrical properties of the cable, and the only limit to its desirable thickness is its expense. The principal weight, and all the available strength of the cable, reside in its sheathing, which should be made of a material combining strength with lightness, and also with hardness, to resist the crushing and tearing action of the brake-wheel; and there can be no doubt that steel wire combines these qualities in the highest degree, nor do I think it would be much dearer than iron if power of suspension was taken for the basis of calculation.

It can easily be shown, by the simple rule given above,

regarding the strain upon the cable in leaving the vessel, that an iron-sheathed cable cannot, under the most favourable circumstances, be laid in water of more than three miles in depth, without a certainty of rupture taking place, whereas a steel-covered cable might be laid, with reasonable safety, to a depth of five or six miles, which depth is, I believe, rarely exceeded in any ocean.

Respecting the paying-out machinery, I have to notice Messrs. Newall and Co.'s apparatus, consisting of a solid centre, and heavy rings to form a double cone for guiding the cable safely out of the hold, and the brake, which latter should be made as light as possible, to avoid jerks upon the cable, and should indicate the variable strain put upon it, to harmonise its speed with that of the vessel.

In order to insure continuity of the electric conductor in a cable, a strand of several copper wires is now generally adopted, instead of a single wire, which latter is found to be very liable to break. This simple but useful plan was, I believe, first thought of and acted upon by myself, having ordered some gutta percha coated strand, for experiment, from the Gutta Percha Company, in the spring of 1855, part of which I have laid upon the table.

The electrical condition of the submerged conductor is a subject of the greatest interest, upon which electricians are still divided, and which, treated mathematically, involves problems of the highest order, such as only Professor William Thomson and a few others can hope to deal with effectually. The important point is, however, to arrive, first of all, at a clear understanding of the laws of nature upon which those calculations should be based, and those laws, when rightly interpreted, are always extremely simple.

The submerged (or underground) line wire may in the first place be considered in the light of a mere conductor, following Ohm's law, which, as is well known, is to the effect that the amount of electricity passing in a given time depends upon the sectional area of the conductor, upon the electric force (intensity) of the battery, upon the specific conducting power of the material, and inversely upon the length of the conductor. It is expressed by the following formula:—

$$1. \quad P = \frac{E a c}{l} \quad \text{in which}$$

P, signifies the quantity of electricity passing;  
E, the electric force of the battery, or its substitute;  
a, the sectional area of the conductor;  
c, the specific conducting power; and,  
l, the length of the conductor.

In the next place, the cable has to be considered in the light of a Leyden jar of extraordinary length, formed of gutta percha, with the conductor for an inner, and the sheathing (or moisture) for an outer metallic coating. This Leyden arrangement has to be charged to a certain degree before the electric current can make itself felt at the further extremity, but the supply of electricity being limited at every point by the resistance offered by the conductor, according to Ohm's law, it follows that the entire cable can be charged only in a progressive manner, as though it consisted of a series of Leyden jars charging the one into the other until it reaches the last, which discharges itself through the receiving instrument into the earth. The amount of impediment thus offered to the progress of the electric current depends evidently upon the capacity of the Leyden arrangement, which capacity should be reduced to a minimum for a given size of conductor.

According to Faraday's definition of dielectrics, the electric charge obeys the same simple law, which regulates the dispersion of heat in an imperfect conductor, and which, again, is analogous to Ohm's law regarding electric currents. It follows that the electric charge of a Leyden arrangement is directly proportionate to the lining surfaces—directly to the electric force of the battery (or its substitute) employed, and to the specific inductive capacity of the insulating medium, but in-

versely proportionate to the thickness of insulating coating; or, if expressed by a formula, we have:—

$$2. \quad Q = \frac{E S k}{d} \quad \text{in which}$$

Q, expresses the electric charge;  
E, the electric force of the battery;  
S, the metallic surface;  
k, the specific inductive capacity; and,  
d, the thickness of coating.

This formula is corroborated by a series of very careful experiments by Werner Siemens upon electric cables, and it is of great practical utility if combined with Ohm's formula regarding the conductor.

The following are some of the simple consequences derived from the two formulæ:—

1. The electric force (E) of the battery (and its substitute) has no influence upon the onward velocity of the electric wave, because it increases the value of P and Q equally.

2. The time ( $t = \frac{Q}{P}$ ) required to charge a submerged conductor of a given proportion increases in the square ratio of the length (l) of the conductor—(in the formula for Q, the factor (S) has to be expressed by l and a)—which law was first arrived at by William Thomson in another way, and was communicated by him to the British Association in 1855, but has since been assailed by Whitehouse and other electricians.

3. It is of the first importance to make the conductor of the best conducting material, and the insulating coating of the greatest practical thickness, but of a material with the least specific conductive capacity.

4. Given the materials and the thickness of the insulating coating, the rapidity of progress of the electric wave increases in the simple ratio of the diameter of the conductor; a proposition differing also from the views of the promoters of the Atlantic cable, who assert that the maximum result is obtained by a conductor of comparatively small diameter.

The results obtained by means of these formulæ are, however, modified by disturbing causes, which have to be taken into account by the electrical engineer. Among these, the conducting power of the gutta percha itself is the most important. It appears, from certain experiments made at Birkenhead by Messrs. Newall and Co., upon one-half of the Atlantic cable, that when the entire cable is formed into an electric circuit, only about one-third part of the current will follow the wire throughout its length, and the remaining two-thirds will pass through the gutta-percha covering to the earth. The relative amount of leakage through the covering increases in an extraordinarily rapid ratio with an increase of temperature; and it must be deemed a most fortunate circumstance that the temperature of the great oceans is probably not above 40 Fahr. at the bottom, being the temperature of maximum density of water. Messrs. Buff and Beete have found that glass also becomes conductive of electricity when but moderately heated; and they attribute the effect to electrolysis, or decomposition of the alkali it contains. In the case of gutta percha, it arises possibly from decomposition of the water of hydration or of some vegetable constituent of that substance. A careful experimental inquiry into this question, including some other deteriorating effects upon gutta percha, would be of great practical importance; and it is to be hoped that the Gutta Percha Committee, lately appointed by this Society, will furnish some valuable information.

The effect of leakage through the coating is retardation, in the direct proportion of the surface of the conductor, and the inverse ratio of the thickness of the coating; but the co-efficient varies according to the temperature and quality of the material. There are some other disturbing causes, of comparatively less importance, namely, voltaic induction and magnetisation

of the iron sheathing by the line-wire current. The voltaic induction, or tendency of one current to produce a current in the opposite direction in another conductor parallel to itself, is of importance only in the case of compound cables, and may even be turned to advantage, if the return current is laid through one of the parallel wires instead of the earth. By the same expedient, magnetisation of the sheathing, which is necessarily a retarding cause, and is, moreover, productive of a disturbing extra-current, may be neutralised.

In calculating the time required for an electric current to traverse a cable of given length and proportion, it may be received as an experimental datum to start from, that it reached the distance of 1,000 miles in one second, in a cable consisting of No. 16 copper wire coated with gutta percha to the thickness of  $\frac{1}{16}$ ths of its diameter, a proportion most generally adopted. The discharge of the same cable would occupy practically about two seconds, and these times go on increasing in the ratio of the square of the length of conductor, in as far as the retardation by electric charge is concerned, and in the simple proportion of losses by leakage, voltaic induction, and magnetisation, the result being a mean between the two ratios.

With these facts before us, it would have been impossible to work an electric telegraph across the Atlantic or Indian oceans with anything approaching a commercial result; and the idea must have been abandoned, but for Faraday's timely discovery that several electric waves may co-exist, following each other, in a long cable, whereby the number of impulses to be transmitted in a given time may be greatly increased.

A difficulty experienced in carrying this method of working into effect, is the partial merging of the separate waves into an almost uniform electric charge of the conductor, which causes the receiving instrument to be permanently affected. This difficulty has however been removed by a return to Gauss and Weber's method of working, in sending always two opposite currents in succession, whereby not only the effective value of each wave is doubled, but accumulation of electric charge is entirely prevented, because the two opposite waves, in emerging, destroy each other. This method of working would, however, not be complete without a return also to the same description of current which Gauss and Weber employed. It has, indeed, been shown above, that currents of high electric force do not travel any faster through submerged conductors than feeble currents, but the advantages of the former are, that each electric wave represents a larger accumulation of force, and travels consequently to a greater distance before it has so far dispersed as to be no longer capable of producing an effect upon the receiving instrument, and moreover, that the positive and negative impulses are equal in amount.

The success of a long submarine line of electric telegraph depends also in a great measure upon the particular construction of both the communicating and receiving instruments. On this point I am in a position to speak from extensive experience, being connected with an establishment which had to contend at an early period with the difficulties experienced upon long underground lines, which has since carried out extensive systems of telegraphs in Russia and other countries, and has furnished the instruments of most of the continental lines, including those in Turkey, India, and Australia. In addition to this there is the experience of the Black Sea and the Mediterranean lines, which are the longest submarine lines hitherto constructed, with the instrumentation of which I was charged by Messrs. Newall and Co., the successful contractors of those undertakings.

Morse's recording instrument combines, as stated before, many practical advantages which recommend it for universal adoption for all mercantile lines, among which advantages is the facility it offers of forwarding messages at intermediate stations without the intervention of a clerk, in putting on a fresh battery, a system first in-

troduced by Siemens and Halske, and perfected by Steinheil, by which it is made possible to speak directly between London and the remote parts of Russia.

The real telegraphic receiving instrument is the relay, which has for its duty to establish and break the local circuit of the recording instrument.

An important point in the construction of a delicate relay was the suppression of the armature of the electro-magnet employed (patented by Werner Siemens in 1851), by allowing one of the two upright bars of soft iron composing the horse-shoe electro-magnet to vibrate upon delicate points, and producing rotary motion by the attraction between approximated horizontal arms extending from the same. The application of magneto-electric currents necessitated a corresponding change in this relay; for, however sensitive it might be made, it was necessary that the effect of the line-wire current should be continued till the recording instrument has had time to make a dot or line upon the paper, and the magneto-electric current, being nearly instantaneous, is unsuited for that purpose. This difficulty has been removed by the introduction of permanent magnets, which continue the effect produced by the instantaneous action of the line-wire current, until the opposite effect is produced by the succeeding negative current. The vibrating tongue of the instrument (Figs. 2 and 3), is for this purpose balanced midway between the similar poles of a comparatively powerful permanent magnet, being equally attracted by both, but remaining in the proximity of either of them, into the attractive sphere of which it happens to be brought by the instantaneous action of the line-wire current, changing for an instant of time the name of one of the contending poles. A relay on this principle was first exhibited at the Great Exhibition of 1851 by Siemens and Halske.

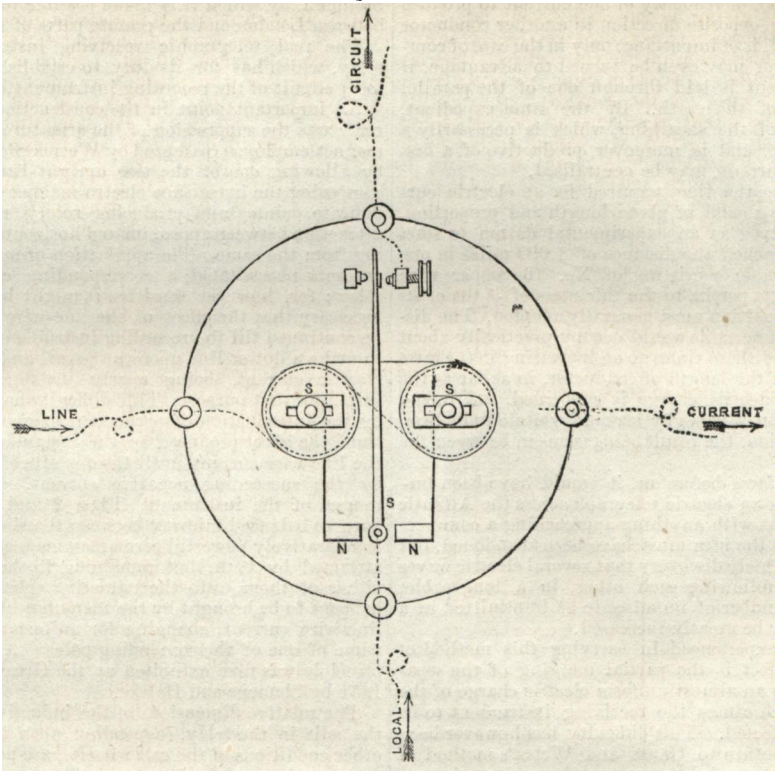
The relative dimensions of the inductive coils, and of the coils in the relay, (depending upon the length and other conditions of the cable itself), are points which require very careful attention. The common practical rule, that the resistance of the coils must be increased with the increased length of conductor, is here entirely at fault, for the electric wave, when once formed, is no longer under the influence of its source, but may be compared to the dying wave of the ocean running up a shallow beach, which would have no power to force its way through a long and narrow tube, but is yet capable of delivering a large quantity of water into an open duct. For an analogous reason the coils of the relay must be composed of comparatively short and thick wire. The same rule applies to the inductive coils, which must be composed of thick wire in order to produce a quantitative wave. The Cagliari, Malta, and Corfu line is worked by instruments upon this principle, and the results obtained are very satisfactory—the messages being worked through the entire distance of 700 nautical miles (without making Malta a relay station) with ease, and at a sufficient rate.

This result proves that telegraphic cables not exceeding a thousand miles in length may be worked satisfactorily, and that, consequently, all reasonable doubts about the successful operation of a line from London to Calcutta may be considered as being removed, a result which I sincerely hope to see soon established in fact.

For distances exceeding a thousand miles, the difficulty of sending messages at an efficient rate for commercial purposes remains yet to be solved, for theory and experience combine to prove that the highest rate likely to be attained in working through a distance equal to the intended Atlantic cable, in taking full advantage of the power of waves, will not exceed three, or it may be four, words per minute, unless indeed some new principle of working is yet discovered, whereby a greater result is realised.

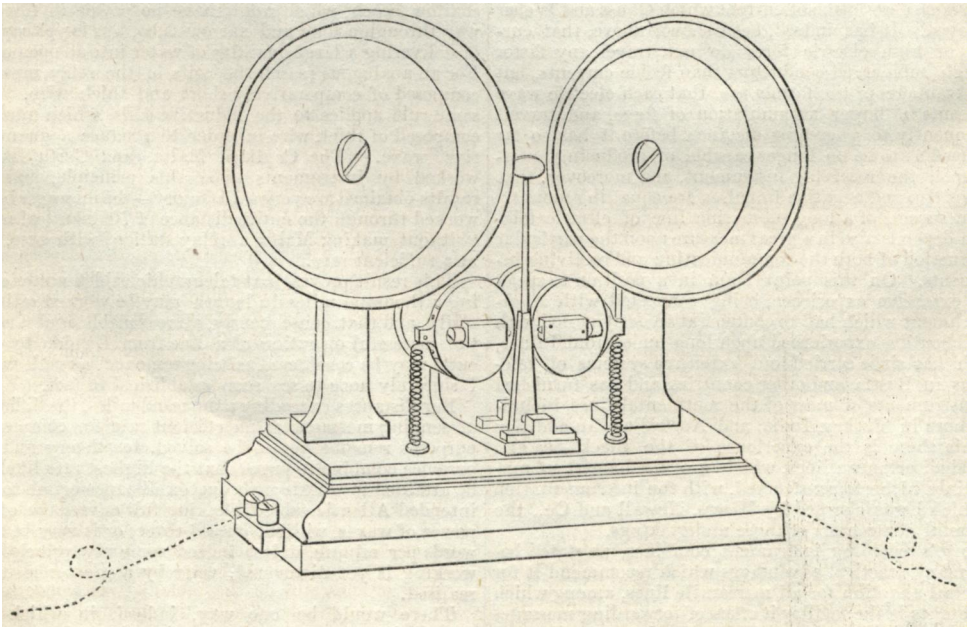
There would be one way, indeed, in which the capabilities, not only of long submarine cables, but of electric telegraphs generally, might be greatly increased,

Fig. 2.



INDUCTIVE RELAY.

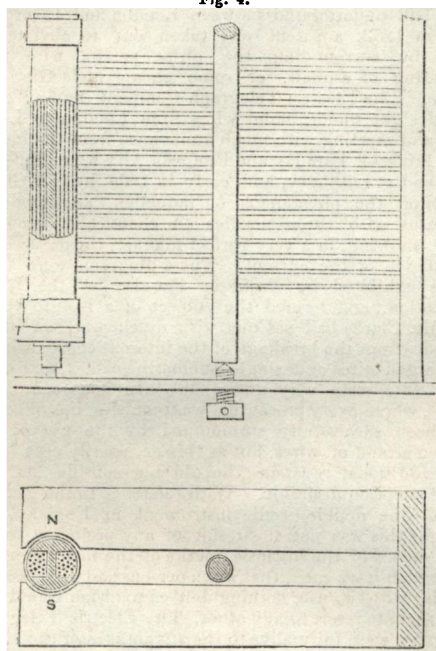
Fig. 3.



INDUCTIVE ALARM.

which consists in combining a number of insulated line-wires into one cable, and working them in metallic couples. This, indeed, is giving up the earth circuit, but, in its stead, we gain the power of working several sets of instruments without disturbing interference between the wires by Voltaic induction. Instead of using one of the wires (say the central wire) for the common return circuit, the metallic pairs might be selected by the rule of permutations, which, if carried out, would enable us to connect 6 pairs of instruments by means of 4 wires, 10 pairs by means of 5 wires, and so on. If a cable of 10 wires was laid between two great commercial centres, say between London and Liverpool, as many as 42 pairs of instruments might be used, which might be placed in the counting houses of great merchants and of their respective agents for their private correspondence, and this step would probably give rise to the more general application of the electric telegraph for private and domestic communication. The instrument that appears to be best suited for such purposes (including railway and town services) is a magneto-electric step by step or dial instrument (Fig. 4), a specimen of which I have placed

Fig. 4.



COMMUNICATOR OF DIAL INSTRUMENT.

before the meeting. This instrument combines the advantages of requiring no battery, with great facility of working, and it contains some novel arrangements, whereby its action is rendered powerful and certain, and which will be best understood from the drawing.

Of these instruments, 180 were adopted last year by the Bavarian Government, in lieu of instruments of a similar class that had been used there previously, and it appears, from an official document, that they give great satisfaction. A pair of them is also in use at the War-office and the Horse Guards; and another pair was taken out by Messrs. Newall and Co., to keep up telegraphic communication between the tender and tug employed in laying the last Mediterranean cables.

My summary of telegraphic novelties would not be complete without a notice of a method of sending messages simultaneously in both directions through one and the same line-wire, the joint invention of the Hanoverian telegraph engineer Frischen and my brother. It consists in splitting the current of the battery into two equal parts,

of which the one proceeds through the line and the other through an adjustable resistance coil by a short circuit to the earth. Both currents pass in opposite directions round the relay magnet of the communicating station, and neutralise each other in effect, but the portion of current passing along the line-wire, produces an effect upon the relay at the receiving station, and *vice versa*, but if both stations include their batteries at the same time, the current of the line-wire will be doubled, and in exercising a preponderating effect upon both relay magnets, will cause both to attract their respective armatures, and establish the printing circuits. By this means, the transmitting power of a single line-wire is doubled. This system works satisfactorily between Amsterdam and Rotterdam, and some other places where there is not much interference by intermediate service, but it is, I consider, as yet too refined for general application. The same objection applies to a system of accelerating the speed of transmission of messages by preparing strips of perforated paper which, in passing between a metallic roller and contact finger, break and restore the metallic current with unlimited rapidity; a system first introduced by Bain, years ago. These plans will very probably be of great practical utility eventually, when the use of the electric telegraph is more extended.

In conclusion, I have to thank the meeting for their patience in listening to this paper, which far exceeds the limits I had assigned to it. I have to express my special thanks to Professor Wheatstone, Mr. Latimer Clark, Dr. Green, Mr. Edward Bright, and Messrs. Newall and Co., for their liberal aid, in furnishing me with models to illustrate the subject.

I wish to draw particular attention to the key and relay arrangements of Mr. C. Varley, which are used upon the Dutch cable, and the acoustic telegraph, worked by secondary circuit, which is used by the British Magnetic Telegraph Company, and which lack of space has prevented me from describing in the paper. The paper is, I am aware, deficient in many respects; but I shall be satisfied if I have succeeded in showing, by what has been done, what greater results may yet with certainty be accomplished, and if, by inviting discussion, I have contributed to hasten the period when the electric telegraph will no longer be the wonder of the age, but will become the simple and ever-ready agent to extend the range of human intelligence and power upon the earth, fettered no longer by the limits imposed by distance.

In conclusion, Mr. Siemens explained the numerous instruments and diagrams before the meeting, amongst which were the early needle telegraphs, by Cooke and Wheatstone; Professor Wheatstone's dial instrument and early magneto-electric arrangements; Bain's chemical telegraph, and Henley's double needle telegraph; the instruments in actual use by the Electric and British Telegraph Companies; the arrangement of instruments used in working the Dutch cables, consisting, on the English side, of Mr. Varley's arrangements, and on the Dutch side of Siemens and Halske's recording instruments; the recording instruments worked by induced currents (produced by a Ruhmkorff coil) used on the Mediterranean cables; Siemens and Halske's new step by step or dial instruments, and the recording instruments by the same firm, which were used upon the East Indian lines and elsewhere; besides a variety of rotary apparatus, alarums, &c.

#### DISCUSSION.

The CHAIRMAN, in inviting discussion, said that perhaps it would be as well that speakers should apply themselves more to general topics, than to the mechanical details of the instruments before them. In looking at the array of apparatus on the table, it was wonderful to think that the whole of these inventions had resulted from the scientific researches of the last half century, which showed how rapid had been the pro-

gress of electric science. He thought that important points for discussion were, the best means of insulation and the best form of battery power. It would be interesting to hear observations upon these two subjects. At present it did not appear that for long lines of telegraphic communication a better insulator than gutta percha could be found, which combined a great degree of insulation with plasticity, toughness, and strength to resist the ordinary accidents to which telegraphs were subjected. It had been remarked by Prof. Faraday that various specimens of gutta percha differed in conducting power, as also in durability. Doubtless very considerable steps in the improvement of the electric telegraph would be effected if they could with certainty produce gutta percha of a quality giving it a greater power of insulation. Another important point was—what was the best form of power to be used for the transmission of the electric current. That must necessarily differ according to the uses to which the instruments were put. A different power was required for short distances to that which would be suitable for long distances, such as the Atlantic telegraph. One advantage of magneto-electric power, as opposed to that of the battery, was that the apparatus was always ready, and only required small mechanical power to work it. It had been found to answer well for short distances, and, with regard to its applicability to long lines, no doubt some opinions would be given that evening. There had of late been many improvements in the means of inducing electricity of high power; for instance, the Rhumkorff coil, by means of which a great increase in the power of the current had been produced; and thus immerse intensity was obtained with a comparatively small battery. It was stated that in order to obtain sufficient intensity to work a length of telegraph such as the Atlantic cable, they would require 500 Daniell's cells, whilst the Rhumkorff coil it was probable they would be able to obtain sufficient intensity with a much smaller number. Another important point was the occasional rupture of the copper wire in submarine cables. It was argued that by having the outer iron sheathing of a twisted or spiral form, whilst the wires of the inner core were straight, there was a greater power of stretching in the outer than in the inner wires, and he did not know how far the breakages that had taken place were due to that circumstance. He thought, however, it was very desirable to have the whole cable so constructed, that the stretching of the wires, if any, should be uniform, and that one part of the cable should not stretch in a greater degree than the other.

Mr. W. SMITH thought Mr. Siemens was slightly in error upon one or two of the facts he had brought forward. He had stated that the first attempt to establish a subaqueous conductor across the open sea, was made by Wollastone (from Dover to Calais), in 1850; and that in the following year Crompton laid a cable between the same places successfully. This cable, it was added, was sheathed with iron wire, according to Messrs. Newall and Co's patent process. He (Mr. Smith) thought there was some mistake here, inasmuch as he was not aware that Messrs. Newall and Co. had any patent for that form of cable. The fact was that in 1847 the first specimens of that form of cable were made for Mr. Brett, who, he believed, patented a system of interoceanic telegraph in the year 1845. Mr. Brett's plan was to coat copper-wire with india-rubber—the best insulator then known—and to enclose the wires in a series of iron tubes, united by ball-and-socket joints. He (Mr. Smith) had no wish to advance any claim to invention in connection with submarine telegraph cables, but he would state that he believed he was the first to communicate to Mr. Brett, in 1847, the idea of protecting the insulated copper-wires forming the core, by a sheathing of iron-wire. Mr. Brett adopted the idea, and in the same year some specimens of that form of cable were made for him. That was long prior to the construction of the Dover and Calais cable. The cable to which Mr. Siemens alluded, was manufactured at Wap-

ping, and was only completed, but not commenced, by Messrs. Newall and Co. It was in consequence of some little difference with the contractor, that Messrs. Newall and Co. undertook to complete the cable, which was done with the very machinery which was originally designed for the manufacture of that form of cable.

Mr. LATIMER CLARK, in reference to the acknowledgment of the labours of Oersted and Ampère in the advancement of electrical science, had been lately struck by a passage in a French work on electricity, published in 1805,\* from which it almost appeared that the influence of an electric current on a magnetic needle, and its effect in magnetising an iron bar, had been noticed and published long prior to the date of Oersted's discovery. Mr. Siemens had erroneously attributed to Professor Faraday the discovery of the possibility of the co-existence of several waves of electricity in one submerged wire. The phenomenon of the slow transmission of currents through submerged wires, was first noticed by him (Mr. Clark), in April, 1852, in the course of a series of experiments undertaken at the works of the Gutta Percha Company, to ascertain how far it would be practicable to work through gutta percha wires laid underground between London and Liverpool; and, in 1853, a patent was taken out to obviate the effect by surrounding the gutta percha wire with a coating of asphalt, or some cheap dielectric substance. The Electric Telegraph Company having completed eight underground wires from London to Liverpool, and meeting with much annoyance from the induction, Professor Faraday and Professor Airy were requested to attend at Lothbury, and, early in 1854, he (Mr. Clark) exhibited the phenomena of induction, and produced diagrams with three needles on chemically prepared paper, showing, in a very perfect manner, the passage and retardation of the current. These diagrams were afterwards exhibited by Professor Faraday at the Royal Institution, and formed the subject of a lecture there. He (Mr. Clark) had not met with much practical inconvenience from the breakage of the internal copper wire in submerged wires and single submarine cables, and cases of fracture were very unfrequent. In deep submarine cables, where every precaution was requisite, the difficulty had been successfully surmounted by the use of the twisted strand of wires, but as this necessarily occasioned some additional resistance, he did not consider its universal adoption desirable. With reference to the general use of the double-needle instrument in England, he thought this was not the result of any prejudice, but a consequence of the intrinsic merits of the instrument itself, which were such, that when persons had once become familiar with its use, nothing but compulsion would induce them to resort to any other. The Electric Telegraph Company were fully alive to the advantages of the Morse instrument, and had employed it extensively on all their principal commercial circuits for many years, and it was in daily operation on thousands of miles of telegraph in

\* *Manuel du Galvanisme*, par Joseph Izarn, Paris, 1805. The passage is as follows, p. 120:—"Appareil pour reconnaître l'action du Galvanisme sur la polarité d'une aiguille aimantée."

"*Preparation.* Disposez les tiges horizontales, *a, b, d*, de l'appareil, Fig. 53, (a common universal discharger), de manière que les deux boutons se trouvent à une distance un peu moindre que la longueur des aiguilles que vous voudrez soumettre à l'expérience; et, à la place des boutons *b, b*, qui sont vissés sur leur tige respective, adaptez aux tiges, ou une petite pince, ou bien un petit ajutage applati. *Usage.* Après avoir placé l'aiguille, de manière que ses deux extrémités soient prises dans les deux petites pinces. Établissez une communication de *d*, avec une des extrémités d'un Electromoteur, et de *a*, avec l'extrémité opposée. *Effets.* D'après les observations de Romagnési, physicien de Trente, l'aiguille déjà aimantée, et que l'on soumet ainsi au courant galvanique, éprouve une déclinaison; et, d'après celles de J. Mojon, savant chimiste de Gènes, les aiguilles non aimantées acquièrent, par ce moyen, une sorte de polarité magnétique."

this country. The needle instrument had, however, such advantages over the Morse in simplicity, in rapidity of transmission, and in facility of use, that they had in vain endeavoured to bring the Morse instrument into extensive use on railways. Nothing but the constant use of the two instruments side by side could enable a person to form a correct estimate of their relative value; and he could assure those who were in the habit of condemning the double-needle instrument on purely theoretical considerations, that they were, from imperfect information, falling into a very great error.

Mr. E. HIGHTON said he objected to the statement in the paper—that the change from magneto-electricity to electricity developed directly by a voltaic battery, was a step in a retrograde direction. Every form of magneto-electric machines hitherto used in Great Britain and Ireland had failed; he instanced the instruments of Professor Wheatstone and Mr. Henley—instruments which, he believed, showed inventive talent of the highest order, but they were not commercially comparable with other plans when voltaic-electricity was employed. The first system of underground wires, as recommended by Mr. Werner Siemens, in Prussia, had proved a total failure, and nearly the whole of the capital invested therein by the Government had been lost.—He preferred the use of electricity produced by a battery and an electro-magnet, to that produced by a permanent magnet, inasmuch as the one could be increased to any extent, according to the weather, while the other could not. He objected to the statement in Mr. Siemens's paper as to Messrs. Newall and Co. being the patentees of the submarine telegraph as now used. The fact was, there was no practical method of making submarine cables published, prior to his own patent of September 21, 1850. He corroborated the statement of the author as to the immense risks that must be incurred in laying submarine cables in great depths of the ocean. He thought that the attention of those connected with the working long lengths of telegraphs should now be directed to a system of codes. He instanced one of his own which contained 800,000,000 times 2,000,000 pre-concerted messages, all of which did not occupy one side of half a sheet of foolscap, and each would not occupy more than twelve seconds in transmission. Although Mr. Siemens had stated that by his instrument he could communicate between London and Odessa, there was no proof that this had been done. With respect to insulation, Mr. Highton remarked that this depended very much on the climate of the country to be passed through. He considered that for England and the west of Ireland, a different kind of insulation was required from that suitable to Italy or India, and such like countries. The telegraphic instruments, batteries, and other apparatus to be employed, ought to be suited to the work to be done, and he believed there was no one telegraphic instrument suitable to all cases throughout the world, but that each particular case required its own special apparatus. With regard to the purification of gutta percha, which had been alluded to by the chairman, he was happy to say that the Society had appointed a committee to investigate the whole subject, and he hoped that great results would accrue from their investigations. With regard to the breaking of the internal copper wire in submarine cables, he remarked that in the specification which he made for the British Telegraph Company's cable between Scotland and Ireland, he put in a clause which compelled the contractor for the making of the cable to give double the lay or twist in the copper wires to that of the outside iron wires, and thus prevent all strain from coming upon the copper wires until the iron wires had broken. The submarine cable of the British Telegraph Company had been most successful. Although weighing 180 tons, and containing six wires, of 25 miles in length, it had now been at work for nearly four years, and every wire up to the present moment was perfect, and since its submergence it had not cost the company anything for repairs. With regard to

the double-needle system of the original Electric Telegraph Company, he stated his belief that, sooner or later, if they were to compete with their rivals, they must use a one-wire system. Mr. Highton then read an extract from a work published by Mr. Ronalds, in 1823, which showed that the first telegraphic message ever transmitted in Europe was transmitted by an Englishman, in the year 1816, and that Mr. Ronalds then recommended the use of underground wires. Mr. Highton then exhibited and explained the instruments invented by himself, and used by the company with which he was connected, and which, through one wire, transmitted the last parliamentary speech of the Queen from London to Liverpool at the rate of 32 words a minute; and, through the same kind of instrument, with three wires, the speech of the American president, containing upwards of 16,000 words, was telegraphed from Liverpool to London at the rate of upwards of 3,500 words an hour, without a single mistake. He was sure that every one present would join in a vote of thanks to Mr. Siemens for his interesting paper.

Mr. PEARSALL regarded the historical record of the electric telegraph, presented to them that evening, as of great value, especially that portion which referred to the experiments of Steinheil. Some years ago, in passing through Bavaria, he (Mr. Pearsall) was charged to ascertain the practical results of Professor Steinheil's researches and experiments, when the Professor stated that he had carried on electro-telegraphic communication without any wire at all, by which he now understood him to mean that he had made use of the rails of the railroad for the line wire, using the earth for the return circuit. With reference to the use of wire rope, he recollected that when the plan of metallic shutters to shopfronts was first introduced, it was found that great wear and tear was experienced in the friction of the chain by which the shutters were raised and lowered; this had been obviated by the introduction of a rope of twisted wire, sufficiently flexible for the purpose. In the course of the experiments for ascertaining what was a proper material for the purpose, attention was drawn to the means by which the extraordinary flights of ballet aërials on the Italian stage were effected, which was found to be by means of twisted wire rope, and the idea was at once adopted. The machinery then used for the manufacture of wire rope was the same in almost all its details as was now employed in the manufacture of the outer sheathing of submarine telegraphic cables.

Mr. VARLEY mentioned that his attention had been accidentally directed to the possibility of constructing a telegraph, the signals of which would be communicated by the sense of touch. He had himself been able, by touching the wire whilst an instrument was at work, to interpret the signals by feeling; and he thought possibly this idea might ultimately be practically worked out. Mr. Varley also gave a description of an instrument exhibited by him, termed the acoustic telegraph. He begged to ask Mr. Siemens at what rate the Malta cable was worked?

Mr. SIEMENS replied he believed at the rate of about 12 words per minute, though that very much depended on the skill of the operator.

Mr. VARLEY added that the experiments with the Atlantic cable had led certain electricians to the conclusion that a small wire conducted more rapidly than a large wire, a conclusion with which he (Mr. Varley) did not agree. If it should be established that the larger wire was the best conductor, he did not apprehend that the expense of a submarine cable would be materially increased by its adoption. The cost of the present Atlantic cable was about £100 per mile, of which sum £60 was due to the outer iron sheathing, and £40 to the copper wire and gutta percha covering, and of this he thought the gutta percha cost the larger portion.

Mr. SIEMENS said, in reply to Mr. Smith, that whatever his or Mr. Brett's merits might be in having first suggested the long spiral iron sheathing of electric cables, there could be no doubt about the fact, as stated in his

(Mr. Siemens') paper, that it was actually constructed according to the process patented by Messrs. Newall and Co., for twisting wire ropes. He felt surprised at Mr. Latimer Clark's assertion, that Oersted, Schweigger and Ampère were not the originators of the science of electro-magnetism. The electric charge in underground line-wire was first observed by his brother, Werner Siemens, and fully described in a memoir, presented to the French Academy in 1849, whereas underground line-wire had not been introduced into this country till 1854. He was glad Mr. Clark acknowledged the superiority of the recording over the needle instrument, but did not feel surprised at his defending the latter, very much on the principle upon which one would defend an absent and dying friend. Mr. Highton had also defended the needle instrument, on account of its comparative simplicity and speed. There might be some degree of force in that argument in regard to this country, where the lines were comparatively short, but a needle telegraph was certainly inadmissible for long and international lines of communication. The defects of the needle telegraph system in this country were, however, sufficiently manifest from the distortions of names and figures which occurred in almost every message received. Mr. Siemens could not admit Mr. Highton's argument against the application of magneto-electric and induced currents. Their failure in all the early attempts had been admitted in the paper, and might be very clearly traced to the short duration of the induced current, which rendered it unfit to exercise any sustained or visible mechanical effect upon the receiving instrument; but he mentioned that, in the construction of the instruments he had placed before the meeting, a new and most important feature had been introduced, that of sustaining the effect produced by an instantaneous current, by means of permanent magnets, the instantaneous line-wire current being only required to disturb for an instant of time the equilibrium between two equal and contending poles. Instruments constructed upon this principle required no adjustment according to the distance and other circumstances, which was another very important point, and there was hardly any limit to be assigned, to which the delicacy of the instrument might not be carried. The chief advantage of induced currents for submarine lines, consisted, however, in their perfect equality.—Respecting the new dial instrument, he wished to draw the attention of the meeting to the means adopted to obtain quantitative induced currents by the application of a series of permanent magnets acting in close proximity upon a long rotating keeper, of the section of the letter H, into the recesses of which the induced wire was coiled, by which arrangement a powerful alarm might even be sounded at a distance of 500 miles, to which distance these instruments worked with absolute certainty. The dead-beat ratchet-motion was also of peculiar construction, which rendered the slip of a tooth impossible even at the highest velocity at which the handle of the instrument could be worked. The mode of receiving messages by touch, which had been mentioned by Mr. Varley, was not new, the same plan having been proposed by Vorsehlmann de Heer (see *Pogg. Ann.*, vol. 46, page 513), in 1839. The most suitable diameter of the conductor, in submarine cables, under given circumstances, might be ascertained, without much difficulty, from the simple formulæ which he had given, and which he had hoped would have formed a principal point in the discussion.

The CHAIRMAN said it was now his pleasing duty to call upon the meeting to join him in a cordial vote of thanks to Mr. Siemens for his very elaborate and valuable paper. He had almost hoped to have heard the battle of magneto-electric and battery power fought over again, as he saw advocates of both systems present. Professor Wheatstone was avowedly in favour of the magneto-electric power, and there had been of late many important improvements in that direction. They had heard that

evening one extraordinary communication from Mr. Latimer Clark, which came with great surprise upon all who were acquainted with the normal history of electricity. This statement was, that Oersted was not the first discoverer of electro-magnetism. If a priority of discovery were established on behalf of any other person, it would come with great surprise upon those who had been accustomed to associate that discovery with the name of Oersted since the year 1821. The only scintilla of any prior claim to the discovery was that which was vaguely put forward by Ritter, a man who was no doubt very much underrated in his day. The Chairman concluded by proposing a vote of thanks for the paper which had been read.

A vote of thanks was then passed to Mr. Siemens.

The Secretary announced that on Wednesday evening next, the 28th inst., a Paper by Mr. J. Arthur Phillips, "On the Progress and Present State of British Mining," would be read.

### ARE MECHANICS' INSTITUTES A FAILURE OR A SUCCESS?

The following letter, addressed to the editor of the *Times*, has appeared in the *Leeds Mercury*.

SIR,—I am sure you would not willingly discourage efforts made by the people themselves for their own intellectual and social improvement; yet I fear your remarks, on the 6th instant, relative to Mechanics' Institutions will have that tendency. Will you allow one who has seen a good deal of these Institutions, from their origin in England to the present time, to lay before you and your readers facts and considerations which prove that these popular associations have done much good, and may be expected to do much more.

In order to judge correctly of the success already realised, or likely to be realised by Mechanics' Institutions, we must consider the objects for which they were established. Those objects were, to promote the intellectual and moral improvement of young men of the industrial classes, to counteract the temptation to sensual indulgences by which they are beset, to supplement an imperfect education, and to introduce to the study of science or art those whose talents or avocations especially led them to such pursuits. They were not intended to be universities, or colleges of science, or academies of art, to give a high and perfect training, such as would make professors, artists, engineers, &c. This was in the nature of things impossible, seeing that their members consisted of young persons engaged during the day in industrial pursuits, and having only their evenings to spare for study, with scanty means for the purchase of books and materials. The ambition of founders of Mechanics' Institutions was extensive rather than lofty: it was to imbue a whole population with intellectual tastes, not to turn out a few accomplished scholars and savans: it was to circulate books through the homes of the humbler classes—not to train authors: it was to assist self-education—not to set up and carry on the complete machinery of education.

Have Mechanics' Institutions, then, in any considerable degree succeeded in attaining these objects? I cannot answer in a very confident or exulting strain, because I know many instances in which they have not effected all that was hoped from them, and some in which for the time they appear to have quite failed. But is there any kind of institution, social or political, governmental or popular, which we can pronounce to be absolutely successful, and especially to have attained all its objects within a single age? Can we assign either perfection or complete success to any of the grand agencies which are carrying on our civilisation—to the pulpit, to the press,

to the university, to the school, to our free political institutions, to parliament itself, to our charities, to our savings banks, to our provident societies, to our administration of justice, to our prison discipline, to our philosophical societies, our academies of art, or our schools of design? In all these things success is partial, and often delayed—perhaps the failures more numerous than the successes; and not unfrequently it is by failure that we learn how to succeed. Our duty is to persevere, to profit by experience, and, if we do not realise all the social improvements we desire, still to press on with a hopeful though modest courage. On the whole, amidst all our failures, society is advancing in knowledge, virtue, and religion—and it is advancing by means of instrumentalities, every one of which we feel to be imperfect.

You have been disheartened by the debts, the mistakes, and the declining numbers of the London Mechanics' Institution. I fear that not a few other instances might be found of similar want of success. But such failures may arise from special circumstances, not from any fault in the principles of the institution. Permit me to mention a few facts, which may revive your hopes concerning this important class of popular associations.

The first Mechanics' Institution formed in England was established in the year 1823. When the census was taken in 1851, returns were received from *one thousand and fifty-seven* Institutions, by far the greater number of which belonged to this class. Dr. Hudson, whose "History of Adult Education" was published in the same year, had obtained independent returns of these Institutions; and he gives a list of 622 Institutions in England and Wales, containing an aggregate of 103,522 members, and with libraries containing 697,355 volumes. We may be certain that neither Dr. Hudson's returns, nor even those of the census, were complete. In the county of York alone, and connected with the "Yorkshire Union of Mechanics' Institutes," we have more than 130 Institutions, containing together 21,000 members, with libraries containing 110,000 volumes, and 300,000 issues of books yearly. At these Institutions, many of which are in villages, an aggregate of 800 lectures were delivered last year. They receive 550 periodicals and 720 newspapers in their reading rooms; the number of pupils in the evening classes is about 6,500; the aggregate yearly income of the Institutions exceeds £11,000. But there are numerous Institutions in this county not connected with our "Union," yet formed on somewhat similar principles.

From these facts may we not take encouragement? Many, like myself, remember the time when neither in our villages nor even in our large towns (with very few exceptions) any of these Institutions existed. At that time, the means of literary and scientific information were extremely few. When Mechanics' Institutions were originated by the practical genius of Dr. Birkbeck, and recommended by the powerful pen of Henry Brougham, they were hailed with delight by the friends of education and improvement, as meeting one of the most crying wants of the age. They consisted of three main features—1st, a library; 2nd, lectures; and 3rd, evening classes. Each of these features is admirably calculated to meet the intellectual wants of the industrious classes. Look, for example, at the library. A working man would perhaps not spend more than ten shillings a year in buying books, and for this sum he might obtain three or four volumes; but suppose 200 working men were to subscribe ten shillings a year each towards a library, they would raise £100, with which they may purchase six or eight hundred volumes, every one of which would be accessible to all the subscribers. But if they choose to lay out only one-half or one-quarter of their money on books, they may still form a good library, and add to it a reading room, occasional lectures, and evening classes. From the lectures they may obtain intellectual stimulus and gratification; and in the even-

ing classes—by far the most valuable department of an Institution—the young may acquire solid and systematic knowledge, together with the habit of steady application, which will be invaluable to them in the pursuits of life.

I hope this very simple explanation may be pardoned, for the sake of the practical importance of the subject. Whether we look at the positive or negative effects of Mechanics' Institutions, they are of great social value—negatively, by saving multitudes of our youth from intemperance and vice; and positively, by training them up to be valuable members of society. I know numbers who have risen from the forms of the evening classes to the position of employers and teachers—some to great prosperity and eminence as manufacturers, engineers, professional men, lecturers, and authors.

May I not, then, regard it as proved that Mechanics' Institutions have to a great extent succeeded? But admitting that the success has not been equal to the wishes of their friends, I would point out that they are almost in their infancy, and that they are receiving, and may still hope to receive improvement. The object of our Unions of Mechanics' Institutes is to ascertain and establish the best modes of management, to communicate to each other the results of experience, to encourage, to stimulate, to help, and to form new Institutions. Some of the Unions employ lecturers, exchange written lectures and papers, lend apparatus, establish itinerant village libraries, collect statistics, form catalogues of books, and provide model rules for the management of Institutions.

One of the most recent and valuable improvements consists in the establishment of a system of examinations for the students of Mechanics' Institutions, and the awarding of certificates or prizes to candidates who acquit themselves well. The Society of Arts in London, which itself forms the centre of a great Union of Institutes, organised a plan for this purpose, which has undergone some changes, but which seems likely to lead to very beneficial results. It is designed to stimulate the teachers and students in the evening classes. Last year there was an examination at Huddersfield, chiefly for the Institutions of Yorkshire, when the following number of candidates presented themselves in the subjects specified, namely, 33 in arithmetic, 18 in mensuration, 12 in trigonometry, 5 in conic sections, 3 in natural astronomy, 7 in statics and dynamics, 6 in practical mechanics, 4 in hydrostatics and pneumatics, 3 in electricity, 4 in heat, 7 in chemistry, 1 in physiology, 1 in political and social economy, 17 in English history, 15 in geography, 9 in English literature, 7 in Roman history and Latin, 17 in French, 8 in German, and a considerable number in drawing. This list indicates that a large range of subjects is taught in some of these Institutions, and the reports of the Examiners expressed satisfaction with the attainments of the students.

I may add that these voluntary associations produce two incidental advantages of the utmost value to our social condition. First, they bring into friendly co-operation men of the different ranks of society, of all religious denominations and all political parties, thus binding together the high and the low in bonds of mutual sympathy and regard, and abating the prejudices which too often embitter party and sect. And, secondly, they call forth the self-relying energy of the people, their public spirit and benevolence, in sustaining organisations for their own and each other's intellectual and social improvement. In most other countries of Europe, the people look to their Governments for these things, where any such Institutions exist at all. In England it is our pride to do them for ourselves, as becomes a free people; and the efforts thus put forth cultivate the virtues of the people, and develop more fully the noble spirit of independence which is the only safeguard of liberty. It is in their

voluntary character that the life and power of these Institutions consists. If they should ever accept pecuniary help from the Government, they will put themselves into bondage, as well as into the ruts of routine, which will make their future improvement hopeless. I trust the real friends of popular advancement will never allow themselves to be seduced into so fatal an error.

Mechanics' Institutions have succeeded to the full extent that they could have been expected, if not to the extent we had wished. They are susceptible of continual improvement, and of adaptation to the tastes of the people and the changing circumstances of the times. When well managed, they flourish. When ill managed, they fail, as it is desirable they should, and ere long better Institutions rise in their place. On the whole they are doing immense good, and they deserve to be cherished as one of the best features of the age.—I am, Sir,

Your most obedient servant,

EDWARD BAINES,  
President of the Yorkshire Union of  
Mechanics' Institutes.

Leeds, April 17, 1858.

### PLATINUM OF BORNEO.

COMMUNICATED BY PROFESSOR S. BLEEKRODE, ROYAL ACADEMY OF Delft.

Several authors on the statistics of metal mention Borneo as a source of the valuable metal Platinum, so much required in the chemical and industrial arts. There are some who calculate that Borneo can produce from 250 to 400 kilograms yearly. It is surprising, but not the less true, that up to the present time the collection of platinum there has been almost neglected.

In 1831, the resident of Banjarmasin, Mr. Hartman, found the platinum scales in the gold sands, and Dr. L. Horner has confirmed it for all the gold sands that are worked in the valleys of the Ratoes mountains of the Laset district. The observations of this much-lamented naturalist soon found their way into the European journals, having been communicated by Leopold von Bach to Humboldt, who called it "Eine bis jetzt wenig bekannte Erscheinung" (Central Asien, 1843 p. 365).

Dr. Horner estimated the amount of platinum in the gold sands of Borneo as one of platinum to ten of gold, and in this proportion he calculated the eventual produce of that island at 300 kilograms (six cwt. per year), and this could possibly be augmented.

The existence of platinum was afterwards confirmed by other naturalists of the Dutch government. Dr. S. Muller, who visited the southern district of Borneo, has given a description of the diamond mines of Martapoera; after the separation of the diamonds by washing the sands, there remain gold and platinum scales; the gold is carefully collected, but the platinum is rejected as valueless, under the name of *mas kodokh* (gold for the frogs), because neither the Chinese nor the natives know how to work it.

Dr. Schwaner, who travelled through the district of the river Barito and the South-Eastern country, during 1843-47, has given an accurate description of the geological position of the three very valuable minerals, diamonds, gold and platinum, as they are associated together in the diluvium of that island. It appears that the same kind of diluvial *débris* from the rocks of the mountains and hilly districts is found, but the relative proportions of the three valuable minerals in it are very different. Where the diamonds are numerous, gold and platinum are scarce, and, on the contrary, where the grains of the noble metals are abundant, the diamond is rarely found. Gold and platinum are also dispersed over a larger area than the diamonds. The diluvial deposits lie superficially in the higher districts of the rivers and

their mountain tributaries; in the lower country the diluvium is covered by the more recent alluvial deposits of the marshy grounds near the coast. The diluvium consists of conglomerates and rock fragments of diorite, syenite, gabbro, quartz in different colours, but the milky quartz is more general; the minutest parts are quartz sand and magnetic iron-sand. The thickness of the diluvial stratum varies between a few feet and as many fathoms. The depth below the surface is likewise very variable and irregular. The subsoil is a kind of loam, the thickness of which is not yet ascertained.

It is very remarkable, that in some districts the platinum ore contains grains of *cinnabar*, especially at Playhary. We have stated above that the proportion between gold and platinum is as 10 : 1; but this relation is very variable, because at Katapan it is 5 : 1, at Soengi-Matjan 20 : 1.

Last year I received a sample of the Borneo platinum ore, which is now beginning to attract the attention of our commercial society. The results of my analysis are as follows:—

#### PLATINUM ORE OF BANJARMASSIN.

Separated by solution in { Iron-oxide and iron	1.13
hydrochloric acid. { Copper .....	0.50
Osmium .....	1.15
Gold .....	3.97
Platinum .....	70.21
Iridium .....	6.13
Palladium .....	1.44
Rhodium .....	0.50
Iron .....	5.80
Copper .....	0.34
Insoluble in aqua regia: Osmiridium and minerals.....	8.83

The osmium was separated by distillation as described by Berzelius. The analysis was executed, following the method of Berzelius and Claus (*Beiträge zur Chemie des Platin metalle*, 1854). The method of Claus is highly commendable for the ease with which the separation of the platinum from the iron, copper, and gold, is effected.

By the magnet no particles could be separated from the ore. It is probable that this had been done before it was forwarded to Europe. It is interesting here to remark on the magnetic properties of platinum. Berzelius was the first who discovered that there existed a magnetic platinum ore and a non-magnetic ore, notwithstanding that the latter contains nearly the same amount of iron combined as the magnetic-ore. His analysis of the platinum ore of Nischnei-Tagilsk, separated into the magnetic and the non-magnetic parts, is generally known, so that it is not necessary to repeat it here. The platinum ore of the Ural, of Pinto in South America, contains likewise a combination or alloy of platinum and iron. The platinum ore, as it is commonly called, is a mixture of different alloys, with iron, copper, and the other platinoid metals. The natural combinations of platinum and iron remind us of the original discovery of this valuable metal, a century ago, when Buffon supposed that the white gold or platinum was not an element but a compound of gold with iron; Bergmann, the Swedish chemist, succeeded in pointing out, in 1777, the elementary condition of the new useful metal. Platinum scales or laminae are frequently covered with *rusty spots* from the iron, and this is removed by hydrochloric acid, as stated in the analysis. The above analysis may be taken as the average of several trials, because the commercial platinum ore is not regular in its composition. Several samples of the same ore, analysed in quantities of two grammes, gave results as follows:—

	A.	B.	C.
Gold .....	4.62	0.90	1.33
Platinum.....	65.22	71.21	75.03
Iridium .....	"	9.23	3.22
Insoluble and osmiridium...	9.61	8.13	10.15

Hence it follows, that Mr. Claus was right, viz., that an analysis of platinum ore should not be undertaken with less than ten grammes ( $\frac{1}{3}$  ounce Troy).

For the *commercial valuation* I followed the method of Sobolewsky, as used at the Mint of St. Petersburg. The gold having been separated by boiling in diluted aqua regia, the ore is dissolved in a mixture of three parts hydrochloric acid 25° B, and one part nitric acid 40° B, in the proportion of 10 or 15 parts acid to one part of ore. The result was—

Platinum .....	70.21
Gold .....	3.97
Not dissolved .....	{ 8.88 being osmiridium and minerals.
Iron, copper, iridium, osmium, palladium, &c. ....	{ 15.38
Iron and copper .....	{ 1.61 separated previously by hydrochloric acid.
	100.00

It is very remarkable that the platinum appears in small circular or oval laminæ, like drops laminated or flattened, as if struck by a hammer; grains with crystalline facettes could seldom be distinguished. I call this very remarkable, because the gold of the same ore exhibits the form of *pepitas en miniature* or microscopic nuggets, or irregular grains; I saw some small globules and octahedric crystals. The platinum of South America has the same appearance.

In the residue, not dissolved in aqua regia, could be distinguished, as stated by Fremy, the *residu en grains* being the alloy of rhodium, osmium, iridium, and the *residu en paillettes* being iridium, ruthenium, rhodium, osmium. The other mineral constituents of this residue were grains or small pebbles of topaz, hyacinthe, ruby (?), diamond, quartz and feldspar.

It is unnecessary to dwell upon the industrial uses of platinum. I will, however, say a few words upon the metals associated with it, because they hold out the promise of many future useful applications, since Deville, at Paris, has taught the method of melting them. By aid of his lamp, platinum is easily melted. At the last Exhibition in Paris we admired the objects made from molten platinum by Savard, and since then attempts have been made to employ it as a plating for copper for cheap chemical apparatus.

The temperature sufficient for melting 300 grammes (0.3 kilogrammes) of platina, melts 90 to 50 gram (0.04 to 0.05 kilogrammes) of rhodium.

The temperature sufficient for melting 100 to 150 grammes (0.10 to 0.15 kilogrammes), platina melts 10 grammes (0.10 kilogrammes) iridium, which was considered as perfectly infusible.

The iridium is commonly alloyed with platinum; the latter is then less attacked by chemical agents and is much harder, but can be hammered and laminated equally well. A large proportion makes the platinum more brittle.

During last year, M. Chapuis, at Paris, stated that rhodium, alloyed with platinum, formed a combination that could be hammered and laminated without difficulty, and that this combination had the excellent property of not being attacked by aqua regia, and thus the earnest wishes of the practical chemist are satisfied.

The American patent of Batchelder recommends alloying iridium with copper for etching purposes. If this be confirmed by experience there will be a new field opened for a useful application of it. The use of the iridosmine for the diamond pens, and of the rhodium for the same purpose, must not be omitted. It is said that one ounce of rhodium fetches in the United States from £2 10s. to £50 according to its purity.

I hope these notices may serve to demonstrate that the platinoid metals, scarcely known to the public, even by name, are very valuable substances, requiring further investigation with a view to future useful employment.

The residue of the platinum ore, a few years ago of a very low value, scarcely £4 per lb. avoirdupois, has already risen in price, and is now saleable at four or five times that amount.

#### SOUTH KENSINGTON MUSEUM.

During the week ending 17th April, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,350; on Monday and Tuesday (free evenings), 3,703. On the three Students' days (admission to the public 6d.), 1,288; one Students' evening, Wednesday, 136. Total, 9,477.

#### Home Correspondence.

##### STEAM-SHIP PROPULSION.

SIR,—I had not purposed to take part in the discussion on Mr. M'Gregor's very interesting paper, read at your meeting on the 14th instant, but having been called upon I could not decline to contribute a few remarks, the expression of which, however, I now beg to amend. Referring to Griffiths's heart-shaped propeller blade, with the narrowest part at the extremity, as distinguished from the ordinary screw with the widest part at the extremity, I intended to observe, that, to have the maximum width at the extremity of the screw has been considered desirable, not, as reported, in order to gain power, but in order to apply the power advantageously by that portion of the propelling surface being the largest where the angle of the blade was supposed to be most favourable to effective propulsion. In prosecution of this idea, the great aim of many inventions has been to neutralize the centre part of the screw, doing the work entirely by means of the extreme portion: for example, some screws are merely flat discs, set at a given angle to the line of the vessel's motion, and fastened to radial arms, the central portion of the screw thus having no propelling effect whatever; and with the same object in view, a screw was designed by myself, with a pitch increasing from the centre towards the circumference, thus neutralising the centre and throwing the great portion of the work upon the extreme portions of the screw. These principles of construction are directly antagonistic to that of Mr. Griffiths. Woodcroft, again, increases the pitch fore and aft, and other screws have been made with both systems of increasing pitch combined; and yet no principle of construction whatever has hitherto been recognised as that which develops the power of the engine with the greatest dynamic effect. This deficiency of our knowledge now, in the twentieth year of the practical application of the screw, is doubtless attributable to the fact that no rule or formula, combining the mutual relations of displacement, power, and speed, as ascertained on trial of a ship, has yet been publicly received and recognised in the mercantile world, as a means of testing the comparative dynamic merits of ships. In fact, at the present day, the character of a steam-ship, as it respects its dynamic properties, is a mere matter of opinionative assertion or braggadocio, not based on any recognized rule involving the mutual relations of displacement, power, and speed that the vessel may, on trial, be found to realize. It has been to remedy this deficiency in marine engineering as a science that I have, for some time past, publicly, through the proceedings of the British Association and of the Society of Arts, and by aid of the *Artizan*, (which periodical has been liberally thrown open for public discussion on this important subject), promulgated the suggestion that great benefit would result to the public interests of the country if every steam-ship, before being taken off the hands of her builders, were put upon a test trial, with a view to her character, as respects dynamic merit, being judged of by the numeric coefficient

or index number resulting from the following rule, namely, Multiply the cube of the speed by the cube root of the square of the displacement, and divide the product by the indicated horse power, or by the consumption of coal per day expressed in cwt., the quotient being regarded as the index number, expressive of the dynamic merit of the ship, or as expressing the comparative dynamic merits of the various ships that may be tested by this rule. This, or any other analogous system of measuring constructive merit by the relative performances of the ships themselves, would give deep-thinking, but unobtrusive, tongue-bound, and personally retiring constructors some chance of attaining that public fame which is one of the rewards of merit, and which every man may laudably cover. The public are the great losers by public fame being denied to merit because unobtrusive, and consequently unknown or buried in obscurity. The merit of a constructor should be determined by the performance of his ship, rather than that the merit of a ship should be inferred, and taken for granted, from the personal performances of its constructor. These remarks have been suggested by a practical fact, which, in my various papers on steam-ship capability, I have before publicly referred to, and which I desire to take every opportunity of adducing and promulgating as evidence that steam-ship construction during the past 20 years has not been based on scientific principles, or even on inductive practice conducive to progressive improvement; but it has been in fact a mere "happy-go-lucky" speculation; and the singular fact to which I refer is this, that even at the present day, it is not prudentially safe for any steam-ship constructor to undertake a contract subject to the stipulation that the ship to be built shall, when tested by the rule above referred to, produce a coefficient or index number of dynamic performance equal to that which was produced by one of the first vessels to which the screw propeller was applied, namely, H.M. steam-sloop *Rattler*, which vessel, when immersed to a displacement of 1078 tons, and propelled by engines working up to 437 indicated horse-power, attained a speed of 9.64 nautical miles per hour, producing an index number of dynamic merit, calculated by the rule above enunciated, equal to 215.5. I admit that this index number of dynamic merit has, on several occasions, been surpassed by steamers of later date, but such performances are mere occasional events, not usually attained or definitely accounted for in such manner as admits of their reproduction being calculated upon with such certainty as to be made the subject of contract guarantee. Can such a state of things be regarded as scientific? Surely, steam-ship construction may be expected to embrace a definite realisation of speed with reference to displacement and power, before it can be regarded as a satisfactory development of science and art.

The extent to which private interests are occasionally ruined by the indulgence of injudicious chimeras as to steam-ship capability, and public interests sacrificed by the employment of vessels of a low order of dynamic merit, constitutes a national detriment of enormous magnitude. The shipping interests have it in their power, in great measure, to remedy this, simply by insisting on the dynamic merit of steam-ships being comparatively ascertained by some recognised formula, and regarded as one of the tests of the intrinsic value of ships, and by their affording to ship constructors statistical information as to the performances of ships at sea, whereby the best types of ships would thus become practically determined; the causes of excellence would be detected by comparison of the elements of construction; good ships only would then fetch a good price; constructive talent would be measured by the index number that may be earned by the actual performance. Excellence would thus be recognised, and meet its due reward.—I am, &c.,

CHARLES ATHERTON.

Woolwich Dockyard, 21st April, 1858.

## Proceedings of Institutions.

BOSTON.—The seventh annual meeting of the members of the Athenæum was recently held, Thomas Garfit, Esq., president, in the chair. The attendance was larger than usual, and between 200 and 300 voting lists were sent in. The report of the committee for the past year states that the condition and progress of the Institution has, on the whole, been satisfactory—the members numbering nearly the same as at the last annual meeting—the financial position being favourable, and the entire Institution being in good working order in every department. The present number of members is 485. The classification of them, given as follows, shows that the Institution has the support of all classes:—Life members 6, members of parliament 4, clergymen 23, magistrates 12, professional gentlemen and bankers 30, hopkeepers 85, manufacturers and tradesmen (not being shopkeepers) 54, shopkeepers' assistants 30, clerks, &c., not in shops 60, country members 60, mechanics 25, schoolmasters and mistresses 16, innkeepers 7, independent gentlemen 20, youths under 21, 38, annual subscribers of one guinea 27, ladies 21. The gross income for the year, including a balance of £36 6s. 1½d. from the previous year, was £308 15s. 2d., and the expenditure £271 5s. 1½d., leaving a balance of £37 10s. 0½d. in hand. Lectures have been delivered by the following gentlemen;—Dr. Cammack, on the "Lays of Ancient Rome," by Macaulay; Herbert Ingram, Esq., M.P., on the "House of Commons;" and by the Rev. P. W. Clayden, on the Proverb, "Where there's a will there's a way." These have been well attended. Other lectures are in prospect. The number of London books had during the year is 420; the issues of the same amount to 5,096; of the Institution's own books (numbering 3,000), the issues were 5,902; and of newspapers and magazines 2,048; making an aggregate of entries amounting to 13,046. A new catalogue of the library has been published during the year. Votes of thanks were passed to the officers and committee, to the lecturers, to the guinea subscribers, and to the auditors. The following is a list of the new committee:—Mr. H. R. Gilson, Rev. P. W. Clayden, Dr. S. A. Cammack, Mr. J. W. Bontoft, Mr. T. Garfit, Mr. W. Garfit, Mr. J. F. Smyth, Mr. W. H. Adams, M.P., Mr. S. H. Jebb, Rev. G. B. Blenkin, Mr. A. Reynolds, Mr. Wise, Mr. F. T. White, Mr. W. E. Chapman, Mr. F. L. Hopkins, Mr. W. S. Greenwood, Mr. C. Wright, Rev. T. W. Matthews, Mr. T. Storr, Mr. G. F. Bayley, Mr. J. Noble, Mr. T. Fricker, Mr. J. M. Knowles, Mr. F. Wells, Mr. F. Cooke, Mr. J. Noble, jun., Mr. W. Gee, Mr. A. Spurr, Mr. T. Small, Mr. P. W. Shout, Mr. J. H. Small.

CHELTEMHAM.—Lectures have been regularly delivered during the winter, both to the members of the Literary and Philosophical Institution and to those of the Athenæum; and, though not in continuous courses upon a given subject, many of them have been of considerable value and interest. The liberal donation of £100, from Dr. Disney Thorpe, has helped materially to reduce the debt by which the former of these Institutions has long been impeded in its action; but the financial position, in each case, is still unfavourable. At the Athenæum, instruction classes have been satisfactorily organised, and very well attended.

HOLBECK (NEAR LEEDS).—The evening classes in connection with the Church Institute were closed (with the exception of the drawing class) for the winter session, on the 25th of March. They have been better attended this session than in any previous one, showing that the benefits offered by this Institute to the working classes are appreciated. The Institute was established in October, 1855, for the sole benefit of the operative part of the community resident in the ancient part of Holbeck, and out of 142 members on the books, 130 are of the number of those who belong to the working classes.

The future prospects of the Institute are good; and there is no question but that, next winter, great progress will be made in all the classes.—The penny bank has been in operation for one year and four months, and the results are most satisfactory. 7,046 deposits have been received, amounting to £398 18s. 7d. The withdrawals, during the same period have amounted to £196 5s. 10d.

## PARLIAMENTARY REPORTS.

### PRINTED SESSIONAL PAPERS.

Parl. No.

*Delivered on 26th March, 1858.*

68. (2) Trade and Navigation Accounts (28th January, 1858).  
 142. Army Stores—Return.  
 165. East India (Stock Proprietors)—Return.  
 187. Cashel Election Petition—Report from the General Committee of Elections.  
 34. Bills—Edinburgh, &c., Annuity Tax.  
 39. Bills—Trustees Relief.  
*Delivered March 27, 29, 30, 31: April 1, 3, 8, 9, and 10, 1858.*  
 125. East India (King of Oude)—Return.  
 140. Metropolis Roads (North of the Thames)—Returns.  
 153. Income Tax Returns (London)—Copies of Correspondence.  
 165. Emigration—Copies or Extracts of Despatches.  
 166. Chinese Prisoners (Hong Kong)—Return.  
 131. Customs Tariffs—Return.  
 163. Patriotic Fund—1st and 2nd Reports of Commissioners.  
 137. Water Companies—Return.  
 144. Australian Postal Service (Australian Mails)—Return.  
 145. Education—Return.  
 162. East India (Coinage, &c.)—Return.  
 170. London Mechanics' Institution—Report of Dr. Lyon Playfair.  
 98 (A 1). Poor Rates and Pauperism—Return (A).  
 138. Revising Barristers—Return.  
 148. Highways Roads and Bridges—44th Report of Commissioners.  
 150. Coinage—Accounts.  
 151. Copper, &c.—Return.  
 154. Intoxication (Scotland)—Returns.  
 160. Westminster New Palace—Copies of Letters.  
 158. East India (Amcer Ali Moorad)—Correspondence.  
 167. East India (Nawab of Surat)—Correspondence.  
 27 (1). Navy Estimates—An Abstract and a Reprint of the Revised Votes.  
 117. Railway and Canal Bills—General Report of the Board of Trade.  
 118. Local Acts (21. Sunderland Dock; 22. North British Railway (Hawick and Carlisle Junction Railway); 23. Llanelly Harbour)—Admiralty Reports.  
 117. Railway and Canal Bills (79. Birmingham Canal Navigations; 80. Blackburn Railway; 81. Lancashire and Yorkshire and East Lancashire Railway Companies; 82. Lancaster and Carlisle Railway; 83. London and North Western Railway (Extension from Longsight) and (Additional Works) (No. 2); 84. London and North Western (Additional Works) (No. 1); 85. Manchester, Sheffield and Lincolnshire, and Great Northern Railway Companies; 86. Manchester, Sheffield, and Lincolnshire Railway (Garston to Liverpool); 87. Manchester, Sheffield, and Lincolnshire Railway (Station at Manchester); 88. Manchester South Junction and Altrincham Railway Nos. 1 and 2); 89. Oxford, Worcester, and Wolverhampton Railway; 90. Portsmouth Railway; 91. St. Helen's Canal and Railway; 92. South Wales Railway (Further Powers, &c.); 93. South Wales Railway (New Railway, &c.); Llanelly Harbour, Newport, Abergavenny, and Hereford Railway; 94. Warrington and Stockport Railway (Capital); 95. Warrington and Stockport Railway (Lease or Sale, &c.)—Board of Trade Reports.  
 41. Bills—Government of India (No. 2).  
 35. — Marriage Law Amendment.  
 37. — Medical Practitioners.  
 42. — Loan Societies.  
 Post Office—4th Report of the Postmaster General.  
 The "Cagliari"—Correspondence.  
 Public General Acts—Cap. 1, 2, 3, 4, 5, 6, 7, 8, and 9.

*Copies of the undermentioned Papers, presented by Command, will be delivered to Members of Parliament applying for the same at the Office for the Sale of Parliamentary Papers, House of Commons.*

- Railway Accidents—Report on, 1857.  
 Assessed Taxes—Cases determined on Appeal.  
 Births, Deaths, &c. (Scotland)—3rd Report of Registrar-General.  
 Turnpike Trusts—1st Report from Secretary of State.  
 Endowed Schools (Ireland)—Letter by Mr. A. J. Stephens.  
*Delivered April 13, 1858.*  
 4 (1). Banks—Supplemental Return.  
 169. East India (Meerza Ali Akbar)—Correspondence.  
 171. Public Income and Expenditure (year ended March 31, 1858)—Account.  
 172. Exchequer Bills—Account.  
 36. Bill—Poor Rates (Metropolis).  
 The Excavations at Budrum—Papers.  
 The "Cagliari"—Appendix to the Correspondence.

*Delivered April 14, 1858.*

149. Metropolis Rates—Abstract of Returns.  
 156. Loan Societies—Abstract of Accounts.  
 171. Public Income and Expenditure (year ended March 31, 1858)—Account (a corrected Copy).  
 113. Harbour, &c., Bills (15. Clyde Navigation)—Board of Trade Reports.

## MEETINGS FOR THE ENSUING WEEK.

- MON. ....Actuaries, 7.  
 Architects, 8. Mr. T. L. Donaldson, "Way-side Memoranda of an Architect during a tour in Ireland, more especially with reference to some of its peculiar ancient remains."  
 Geographical, 8½. I. Mr. William Lockhart, F.R.G.S., "On the Importance of Opening the Navigation of the Yang-tse-kiang, and the changes that have lately taken place in the bed of the Yellow River, &c." (2nd Part.)  
 11. Mr. James S. Wilson, "Notes on his Journey in North-west Australia."  
 TUES. ....Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."  
 Civil Engineers, 8. Mr. R. Jacomb Hood, M. Inst. C.E., "On Railway Stations;" and Prof. Airy, Hon. M. Inst. C.E., "Further Explanatory Observations on the Laying of Telegraph Cables."  
 Med. and Chirurg., 8½.  
 Zoological, 9.  
 WED. ....Society of Arts, 8. Mr. J. A. Phillips, "On the Progress and Present State of British Mining."  
 Geological, 8. I. Mr. C. Bunbury, "On Fossil Leaves from Madeira." II. Mr. E. W. Binney, "On the Structure of Stigmara Ficoides." III. Mr. J. W. Dawson, "On the Lower Coal-measures of British America."  
 IV. Rev. T. Brown, "On some Sections of the Scottish Coal-measures." V. Mr. J. Morris, "On a species of Fern from the Coal-measures of Worcestershire."  
 Archæological Asso., 8½.  
 THURS. ....Zoological, 1. Anniversary.  
 Royal Inst., 3. Prof. Tyndall, "On Heat."  
 Royal Society Club, 6.  
 Antiquaries, 8.  
 Royal, 8½.  
 FRI. ....London Inst., 8. Anniversary.  
 United Service Inst., 3. Capt. Schaw, "On Gunpowder as a Disruptive Agent."  
 Royal Inst., 8½. Prof. A. C. Ramsay, "On the Geological Causes that have influenced the Scenery of Canada, and the North-eastern Provinces of the United States."  
 SAT. ....Royal Inst., 2. Annual Meeting.  
 Medical, 8.

## PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

*[From Gazette, April 16, 1858.]*

*Dated 12th March, 1858.*

498. M. Smith, Heywood, Lancashire—Imp. in looms for weaving.  
 508. J. T. Coupler, Paris—Treating vegetable fibrous matters, to render them applicable for the manufacture of paper and pasteboard, and in apparatus connected therewith.

*Dated 15th March, 1858.*

526. J. Aked and J. Crabtree, Halifax—Imp. in the arrangement of machinery or apparatus for warping and beaming yarns for weaving.

*Dated 20th March, 1858.*

588. J. T. Pitman, 67, Gracechurch-street—Imp. in the manufacture of soap, and in the apparatus connected therewith. (A com.)  
 589. J. T. Pitman, 67, Gracechurch-street—Imp. in the mode of preparing and moulding clay into bricks, tiles, pipes, and other similar manufactures. (A com.)

*Dated 22nd March, 1858.*

594. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the metallization of objects for the electrotype or galvanoplastic process. (A com.)  
 598. J. Wright, 10, Alfred-place, Newington Causeway—An improved method of, and apparatus for, punching rolled metal plates and angle iron. (A com.)

*Dated 24th March, 1858.*

622. W. Wood and R. Wood, Radcliffe, Lancashire—Imp. in machinery or apparatus for spinning, doubling, and sizing yarns or threads.

*Dated 25th March, 1858.*

634. J. Young, Knarborough—Improved apparatus for signalling on railways by day and night.

*Dated 26th March, 1858.*

638. W. Moxon, J. Clayton, and S. Fearnley, Bluepits, Lancashire—Imp. in machinery for paying out electric telegraph cables, ropes, and other like articles.  
 640. J. Parkes, Birmingham—An imp. or imps. in eyelets.  
 642. R. M. Butt, Fairfield Works, Bow—Imp. in the manufacture of night lights.

*Dated 27th March, 1853.*

646. V. F. Jeanne and E. M. G. Martin, Paris—A machine for breaking stones.  
 650. J. Bushell and T. Wright, Manchester—Imp. which make grids for covering openings, through which fuel is deposited, in vaults or cellars, self-securing.  
 652. W. W. Eley, Broad-street, Golden-square—Imp. in cartridges.  
 654. J. A. V. Burq, Paris—Imp. in weighing machines.

*Dated 29th March, 1853.*

658. W. Garnett and C. Geldard, Low Moor, near Clitheroe, and J. Dugdale, Blackburn, Lancashire—Imp. in looms for weaving.  
 660. W. Chadwick, Bury—Imp. in the hoods or tops, and in the footsteps and bearings of ventilators.  
 662. J. Horton, Smethwick, Staffordshire—New or improved machinery to be employed in punching metals.  
 664. J. C. Durand, Pimlico—An imp. in the manufacture of chain cables.

666. G. Paterson, Glasgow—Imp. in apparatus for effecting the combustion of fuel and the consumption or prevention of smoke, applicable to boiler furnaces.

668. W. Davis, 11, George-street, Chick's-buildings, and T. Harper, Brewery-house, Broadplains, St. Phillip's, Bristol—Imp. in apparatus for cutting soap.

*Dated 30th March, 1853.*

670. F. Robinson and E. Cottam, Pimlico—Imp. in hydrostatic and other presses.

672. W. Weallens, 12, Elswick-villas, Newcastle-upon-Tyne—Imp. in parabolic governors, and in the mode of applying the same to steam engines.

674. T. Steven, T. Reid, and T. Frew, Glasgow—Imp. in making moulds for casting.

676. W. G. Whitehead, Birmingham—A new or improved water-proof paper.

678. W. Oldfield, Skipton, and T. O. Dixon, Steeton, Yorkshire—Imp. in gas burners.

*Dated 31st March, 1853.*

680. J. Musgrave, jun., Globe Iron Works, Bolton-le-Moors—The application of the heat from the furnaces of singeing or dressing plates to generating steam and drying purposes, and imp. in the construction of such furnaces.

682. J. W. Duce, Wolverhampton—Imp. in locks and latches, and in attaching knobs to lock and latch spindles.

684. J. H. Whitehead, Royal George Mills, Saddleworth, Yorkshire—Imp. in making woollen bags.

686. J. Mercer, Cambridge, U.S.—Imp. in the manufacture of leather.

688. H. Napier, Hyde-road, Ardwick, Manchester—An improved process in the production of volatile oil of resin.

690. R. Peter, Dundee—Imp. in gill machinery for the preparation or manufacture of textile materials.

*Dated 1st April, 1853.*

692. A. Pelez, 9A, Mortimer-street, Cavendish-square—Imp. in hydraulic machines. (A com.)

693. E. A. Colette, Dieppedalle, near Rouen, France—Hashing meat with a mechanical chopping-board.

694. A. P. Dudley, New Hall-street, and N. Brough, Birmingham—An improved buckle or metallic adjuster for adjusting braces, belts, garters, and such like articles of dress.

695. F. R. Tavernier and J. A. F. Tavernier, 213, Rue Saint Dominique, St. Germain, Paris—Imp. in machinery for combing wool or other fibrous materials.

696. F. J. E. Oosterlock, Paris—An improved valve or plug for the passage of water or other fluids.

697. H. Ward, Hamburg—Improved machinery for expressing liquids from organic substances.

698. W. E. Newton, 66, Chancery-lane—Improved machinery for manufacturing corks. (A com.)

699. H. Bentley, Horton, near Bradford—Certain imp. in machinery or apparatus employed in preparing and spinning worsted and other fibrous substances.

700. T. Boardman, Pendleton, and J. Allcock, Stockport—Imp. in looms.

701. C. G. Russell, Manchester—Imp. in machinery or apparatus for printing.

702. T. F. Robinson, Halifax—Imp. in apparatus for cutting cork.

*Dated 3rd April, 1853.*

703. T. Greenshields, 11, Little Titchfield-street—Imp. in treating ammoniacal liquor produced from coal in making gas and obtaining useful products for making artificial manure.

705. V. Gache, senr., Nantes, France—An imp. in the construction of steam engines for the use of vessels.

706. A. Pelez, 9A, Mortimer-street, Cavendish-square—A new steam piston for horizontal and vertical engines. (A com.)

708. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in ships' propellers. (A com.)

709. C. Tress, Blackfriars-road—Imp. in or applicable to the class of hats made from palm leaf, grass, chip, Tuscan, Leghorn, Panama straw, and other like materials.

710. J. Fowler, junr., 28, Cornhill—Imp. in apparatus used when ploughing, tilling, or cultivating land by steam power.

711. W. Crowley, Newport Pagnell—Imp. in combining and working ploughs.

712. D. Morrison, Birmingham—Imp. in boiling oils.

713. H. Cartwright, Dean, Broseley, Shropshire—Imp. in the construction of excentrics and in the mode of working them when applied to steam engines.

715. S. Minton and R. H. Thomas, Clough Hall Collieries, Staffordshire—An improved construction of battery.

716. R. Targett, Windmill-street, Finsbury—Imp. applicable to lamp-glasses or shades.

717. A. V. Newton, 66, Chancery-lane—Imp. in machinery for cutting veneers. (A com.)

718. J. Stobbs, Sydney-street, and G. R. Hall, Linskill-street, North Shields—Imp. in pumps for raising water and other liquids.

*Dated 5th April, 1853.*

719. W. Clark, 53, Chancery-lane—An improved construction of water tank for ships and other vessels, and mode of applying the same on board a vessel, whereby it is capable of conversion into a float for saving life and property in case of the foundering of the vessel. (A com.)

721. J. C. Dieulaufait, 2, Rue Sainte-Apolline, Paris—An improved method of manufacturing garments, whereby one garment may be changed in form to that of several others.

723. R. C. H. Groombridge and H. Groombridge, 5, Paternoster-row, and J. Musselwhite, 19, Aldersgate-street—Imp. in a black-board and apparatus for teaching music.

725. O. Sarony, Scarborough—Imp. in producing photographic portraits.

*Dated 6th April, 1853.*

727. W. B. Webster, Adam-street—An imp. in making of butter.

729. E. Owen, Blackheath—Imp. in the manufacture or production of artificial fuel, and in the application of the same to metallurgical purposes.

731. R. Hornsby, junr., Spittlegate Works, Grantham—Imp. in ploughs.

733. H. Schwietzer, J. Holder, and J. Broughton, Scarp Castle, Brighton—Concentrating and retaining the valuable properties of farm yard and stable manure.

735. D. Davy, W. Bentley, and J. Davy, Bradford—Certain imp. in looms employed for weaving.

737. J. Sangster, Newington—Glazing in wood without putty.

739. R. H. Collyer, Marylebone—Imp. in the manufacture of paper. (A com.)

#### INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

749. E. Foster, Connecticut, U.S.—A new and useful or improved life-preserving berth for navigable vessels.—7th April, 1853.

752. S. O. Mason, Connecticut, U.S.—Certain new and useful improvements in door hinges. (A com.)—8th April, 1853.

753. E. Richmond, Massachusetts, U.S.—Certain new and useful mechanism for reducing, or reducing and crushing, and in various other respects treating grain, sugar cane, tobacco, or other substance or substances. (Partly a com.)—8th April, 1853.

#### WEEKLY LIST OF PATENTS SEALED.

*April 16th.*

2648. D. Guthrie and J. Vavasour.

2657. J. Bentley.

2659. J. Eastwood.

2660. R. A. Brooman.

2664. L. De Cristoforis.

2666. J. Schmidt.

2672. H. Wimbball.

2675. W. Bentham.

2706. A. V. Newton.

2736. W. Clark.

2750. W. Padgett.

2770. L. de Landfort.

2778. J. L. Norton and E. Wilkinson.

2862. H. Bessemer.

2912. T. F. Brabson & G. Hughes.

42. J. A. M. Chaffour.

284. P. Molinari.

370. W. K. Foster.

*April 20th.*

2631. G. H. Smith.

2634. C. Tooth and W. W. Wynne.

2639. R. Duke.

2691. J. Bethell.

2696. J. Milne.

2699. J. Smith.

2704. W. H. H. Akerman.

2712. J. J. Schuessel and P. J. Thourret.

2775. P. B. Kyishogloo.

2782. M. F. Isoard.

2783. C. Iles.

2837. T. Rowcliffe.

2897. W. Smith.

237. C. Askew and D. Ritchie.

#### PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

*April 12th.*

816. J. Templeton.

858. J. Lawson and S. Dear.

*April 15th.*

863. J. Cowley and D. P. Sullivan.

841. P. A. Devy.

849. H. Woodhouse.

1045. G. Taylor.

*April 16th.*

845. E. E. Allen.

#### WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4078	April 17.	Improved Roof Lamp .....	T. Truss .....	Chester.
4079	" 20.	{ Improved Spring Mattress for ensuring Purity of Air and Ventilation .....	W. M. Staunton .....	Birkenhead, Cheshire.